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ALEXANDER L. STEVAS,  
CLERKNo.  

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In The  
**Supreme Court of the United States**

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October Term, 1983

KIMBERLY-CLARK CORPORATION,

*Petitioner,*

vs.

PETER GABOR KALMAN,

*Respondent.*

*Petition for a Writ of Certiorari to the United States Court of  
Appeals for the Federal Circuit*

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**APPENDIX**

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United States Court of Appeals for the Federal Circuit

PETER GABOR KALMAN,

Appellee,

v.

KIMBERLY-CLARK CORPORATION,

Appellant.

) Appeal No.

83-540.

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DECIDED: July 19, 1983

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Before RICH, DAVIS, BENNETT, SMITH, and NIES, Circuit Judges.

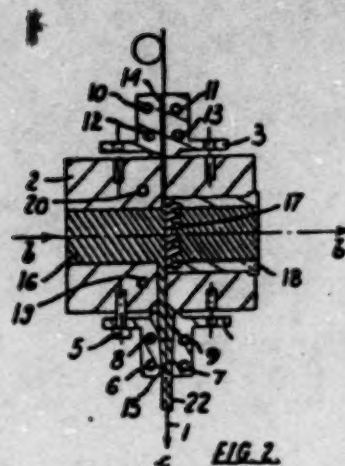
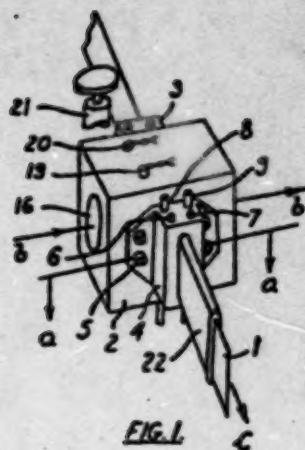
RICH, Circuit Judge.

This appeal is from the September 17, 1982, judgment of the District Court for the Eastern District of Wisconsin, sitting without a jury, holding claims 1, 3, 15, 18, 20, 23, and 25 of appellee Kalman's U.S. Patent No. 3,471,017, issued October 7, 1969, entitled "Filtering Process and Apparatus," valid and infringed by appellant Kimberly-Clark Corp. ("KC"). 561 F. Supp. 628. We affirm.

Background

1. The Invention

The Kalman patent describes and claims a process and apparatus for filtering a heat-softened substance, for example, a thermoplastic, by introducing a filter ribbon across a passage through which the substance flows. Figs. 1 and 2 of the patent are here reproduced.



Important to the device are sealing ports 3 and 4 where, through control of heaters 6, 7, 10, and 11, and water cooling channels 8, 9, 12, and 13, the temperature is kept within a lower range than that of the enclosure containing the hot plastics melt so that "the quantities of rigid and semi-rigid plastics material situated within the channels of these ports act as self replacing sealing plugs at the entry and exit zones of the filter ribbon." The filter ribbon or screen is shown at 1. The filtering device is for use in plastics extruders between the feed screw or ram and the outlet die.

A significant feature of the invention is that the extrusion process need not, as with some prior devices, be interrupted to change filters. Nor does it utilize methods such as redirecting flow or incorporation of two filters on a slide to be reciprocated as one filter becomes clogged or damaged. The patent describes two primary methods of advancing the filter ribbon, which rests against and is supported by

breaker plate 17, continuous and intermittent. The filter may be

\* \* \*forwarded through the filtering enclosure in steps by periodically shutting off the water supply to ports 3 and 4 by means of a valve, not shown, and by raising the temperatures of these ports by means of the cartridge heaters \* \* \* . As the outer skins of the substantially solid plastics plugs within ports 3 and 4 gradually soften ribbon 1 becomes free to move. Since the cross-sectional area of exit slot 15 is larger than that of inlet slot 14 and since both plugs are still keyed onto ribbon 1 a net hydrostatic force exists which forwards ribbon 1 in the direction of arrow c together with the two plugs.

Continuing, Kalman emphasizes that it

\* \* \* will be ready [sic] seen by those skilled in the art that the invention lends itself also to continuous rather than periodic operation; in this method of operating the invention ports 3 and 4 are maintained at intermediate temperatures which facilitate the required slow but continuous forwarding of ribbon 1 through the apparatus.

Kalman also notes that "Economy in the consumption of filter cloth may be achieved by using an endless, recirculating filter ribbon loop; the impurities are filtered out as in the preceding embodiments of the invention and the surrounding solidified plastics material forming the sleeve 22 may be continuously removed, together with the entrapped impurities for example by melting or by solvent extraction."

Kalman concludes that

\* \* \* the essential feature of the invention [is] that the filter is provided in the form of an extended ribbon which passes through a

filtering enclosure sealed by partially or fully solidified end plugs formed of the material which is being filtered. Replacement of the clogged filter areas and removal of the impurities from the stream of the material being filtered is achieved by a substantially transverse movement of the filter ribbon. This may most simply be brought about by utilizing the hydrostatic pressure present in extruders but may also be caused, enhanced or retarded by direct mechanical pull at either end of the ribbon.

The claims in issue read as follows (paragraphing of steps or elements as used in KC's stipulation):

1. A process for filtering a heat-softened substance flowing through a passage comprising the steps of

introducing a filter in the form of a filter band or ribbon by passing it through inlet and outlet ports flanking said passage so that a part of the filter extends across said passage,

forcing the substance through the filter part to filter said substance whilst providing temperature conditions at said inlet and outlet ports resulting in the formation within said ports of sealing plugs of said substance of adequate rigidity to prevent substantial leakage at said ports, and, when desired,

effecting movement of said filter through said ports under conditions providing for self-maintenance of said sealing plugs to introduce another part of said filter band or ribbon into said passage.

3. A process as claimed in claim 1 wherein movement of said filter is effected intermittently.

15. A process as claimed in claim 1 in which said substance is a heat-softened plastics material.

18. A filtering device, for filtering a heat-softened substance, including

A body defining a passage through which said substance can be caused to flow and

slotted inlet and outlet ports flanking said passage through which a filter in the form of a band or ribbon is passed and can be moved to introduce different parts of said filter across said passage,

said ports being adapted for the formation therein, in use, of sealing plugs of the substance being filtered permitting movement of said filter through said slots without substantial leakage of said substance, and

means to provide temperature conditions at said ports to form said plugs.

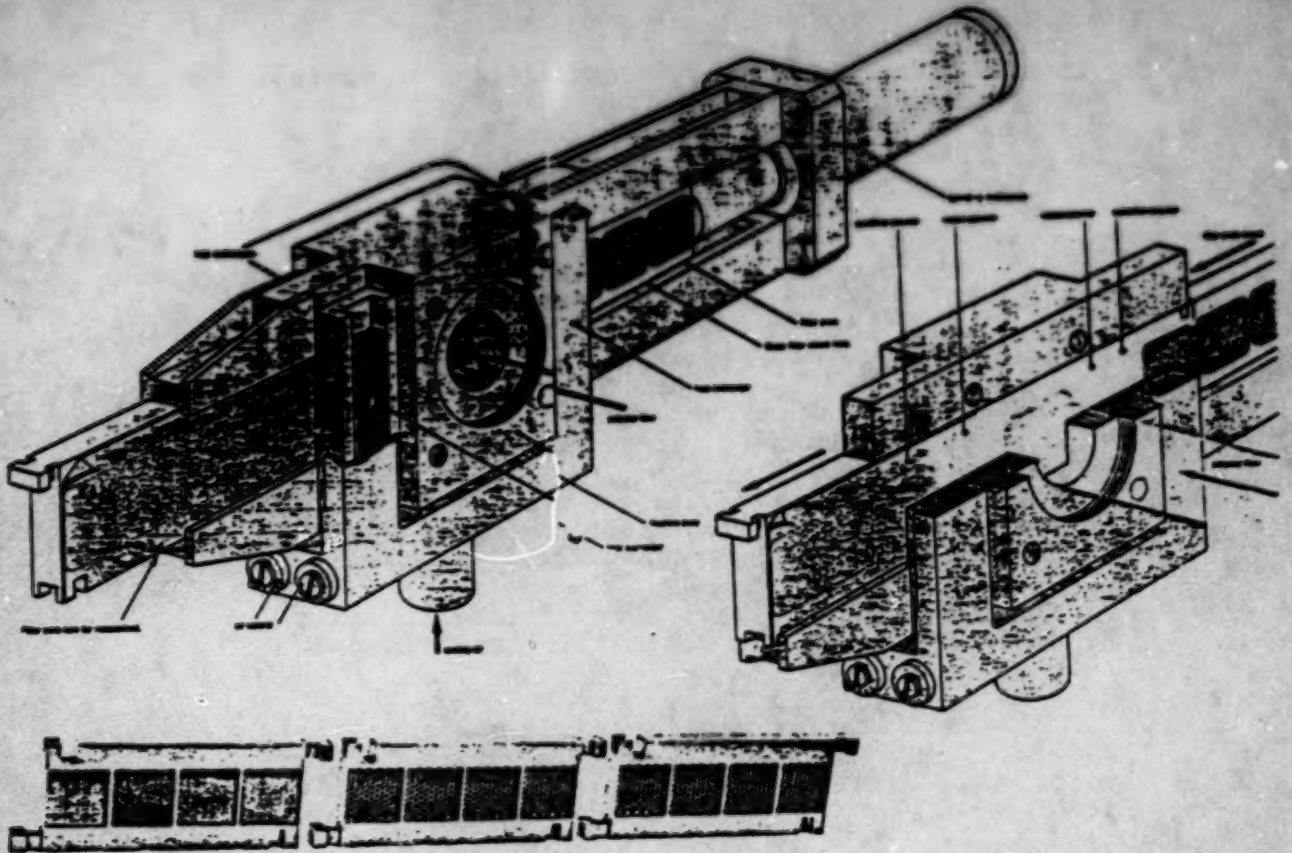
20. A filtering device as claimed in claim 18 wherein each slotted port defines an extended channel through which said filter passes.

23. A filtering device as claimed in claim 20 including means for controlling the temperature of each port.

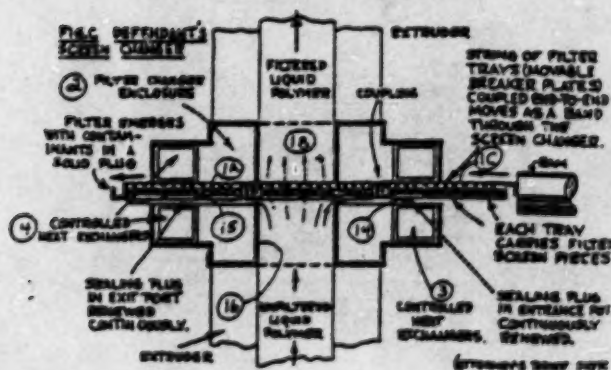
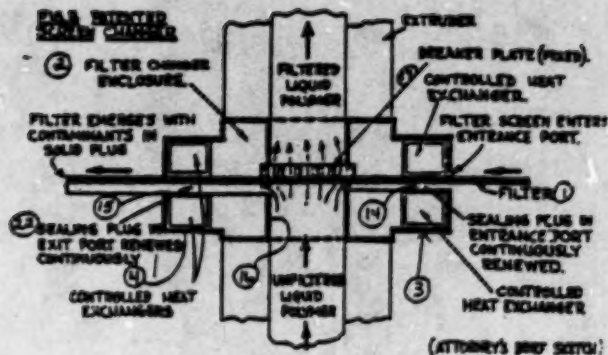
25. A filtering device as claimed in claim 20 wherein the channel of at least one of said ports is parallel sided over at least part of its length.

## 2. The Accused Infringing Devices

The accused infringing devices are Berlyn Continuous Filters Model Nos. CF3539 and CF4549, purchased and installed by KC in 1977. These devices, one of which is depicted below, are essentially identical and differ only in size. They use a hydraulic ram to incrementally push a series of three interlocked filter plates across the extrusion passage. The Berlyn brochure states that "each filter plate has rectangular recesses into which the actual filters are placed. The filters rest against a breaker plate carefully perforated to allow the passage of polymer through the entire arrangement with an absolute minimum drop in pressure."



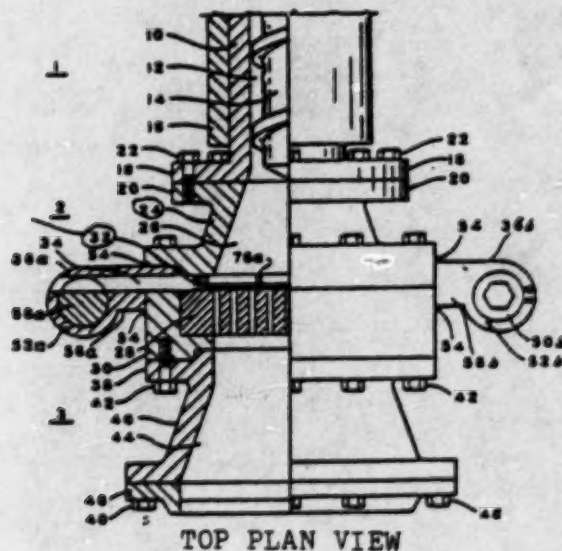
A simplified visual comparison of the patented and accused infringing screen changers is provided by an attorney's sketches reproduced below, patented changer at the top, accused Berlyn structure at the bottom, the latter employing the interlocking filter plates shown above pushed through the unit from right to left by the ram.



### 3. The Prior Art

The principal prior art reference relied upon, which is not listed in the Kalman patent, is U.S. Patent No. 3,112,525, issued December 3, 1963, to Moziek for an "Apparatus for Extruding Thermoplastic Material." The patent describes an extrusion device that utilizes single slidable cartridge filter assemblies each of which consists of a perforated screen holder, a screen, and a ribbed screen retainer. The filter is said to be changed without interrupting extrusion, but changing is done by opening valve means located on either side of the filter receiving passage and inserting a fresh filter cartridge, which pushes the clogged filter cartridge out

through the opposite valve means. The Moziak device is shown below, 32 being the slidable cartridge assembly and 36a and 36b the rotatable valves:

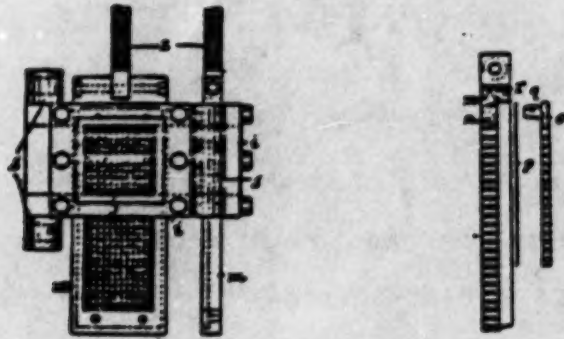


Moziak states that

The tendency of most thermoplastic materials to leak past the valve means is generally dependent on the fluid viscosity of the thermoplastic material at the temperature of the extrusion. For materials of low fluid viscosity, it has been found that leakage can be further reduced by supplemental cooling of the valves. This may be most conveniently done by hollowing or jacketing portions of the valve means to permit circulation of a cooling medium.

Garrahan, U.S. Patent No. 1,195,576, issued August 22, 1916, describes and claims a "Rubber-Reclaiming Machine." The "invention relates to means for straining scrap rubber and the like materials to remove therefrom foreign bodies, such as metal, wood, stone or other hard pieces or particles that have been incorporated therein in the previous uses to which the

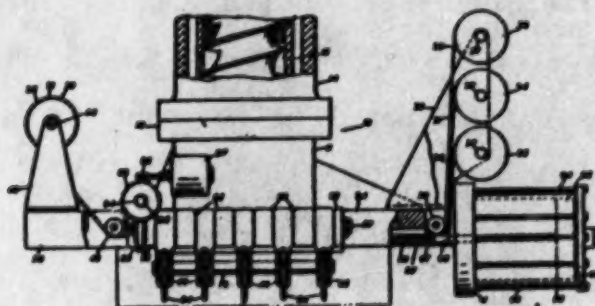
material may have been put." The patent shows a long filter plate m extending out of the filtering device. This construction, shown below, enables the operator to move the strainer "from time to time so as to shift one part of the straining area out of the straining position and another into straining position to enable cleaning of the former while the straining operation proceeds uninterrupted." Movement is accomplished through attached screw z.



U.S. Patent No. 3,007,199, issued November 7, 1961, to Curtis for an "Extruding Head Filter," discloses a slide screen changer which has "a plurality of filter screens within a plastics extrusion machine arranged in a manner so that the screens may be alternately placed into operation very quickly by hydraulic means so that one of the screens is always in operation while the other is exposed to permit cleaning."

KC maintains that the pertinent teaching of Lodge patent No. 2,507,311, issued May 9, 1950, for a "Strainer," is "the use of long bands or ribbons of filter screen material 30, 31,

and 32 from rolls 33, 34 and 35." Kalman emphasizes that "the machine disclosed by Lodge must be shut down to effect a screen change." Below is Fig. 1 from Lodge showing the strainer as part of a tubing extruder.



KC states that patents to Joukainen, Welt, Thomas, and Lehner were cited "merely to show that the thermoplastic working art recognized one could use cooling to make a thermoplastic material or a heat-softenable material act as a seal when it is solidified by cooling." Emphasizing that the patents disclose rotary screw extruders or rotary pumps for plastic material, Kalman counters that "none of these four patents discloses or suggests that the plastic material can form seals by being solidified, for any purpose, and certainly not for sealing filter members."

#### 4. Proceedings in the District Court

Without waiving any of its defenses respecting validity, KC stipulated that the asserted claims "read on" the accused infringing devices, but for the limitations in claims 1 and 18 which speak of a filter "in the form of a band or ribbon."

Since all other claims depend from 1 or 18, this limitation is common to all claims in suit. On his motion for summary judgment on both validity and infringement, Kalman presented the affidavits of two experts, both of whom concluded that both the Kalman and Berlyn devices have a band of filter material. Kalman also presented the testimony of three KC employees, two of whom seemed to accept Kalman's attorney's suggestion that the accused screen structure was like "a train of screen pieces" connected end to end moving through the apparatus. The other employee agreed to characterize it as "one long plate," or "like a band of filter material along the entire length of this plate, but for [the] dividers." Because KC presented "no affidavits or other documents which controvert this testimony," the court concluded "that no facts are in dispute on the issue of the band or ribbon." The court also concluded that "the filters used in the Berlyn device are equivalents of those described in the patent," and granted in part Kalman's motion for summary judgment, ruling that the Kalman patent was infringed but declining to rule on its validity. 215 USPQ 158 (E.D. Wis. 1981). The conclusion of equivalence is not challenged on appeal.

Because the district court felt that KC's arguments regarding validity presented genuine issues of material fact for trial, the court denied the remainder of Kalman's motion. In addition to arguing that the Moziek patent casts doubt on the validity of the claims in suit, KC asserted that the "effecting movement" language of claim 1 "must be interpreted

as being the type of movement for the filterscreen which relies on a differential pressure acting on the plugs formed in the filter inlet and outlet ports to impart movement to the filter-screen device." If the claim is not so limited, KC argued, it is invalid over the prior art; if it is so limited, KC asserts that there is no infringement.

After a four-day trial, the district court found all claims directly infringed by the Berlyn devices:

These claims contain no reference to movement of the filter by hydrostatic pressure. Method claim 1 refers merely to "effecting movement" of the filter. When one looks to other claims, it becomes clear that "effecting movement" in claim 1 does not refer to one means of moving the filter. Alternate means of effecting movement are set forth in claims 5, 6, and 7. Claim 7 states that a "tractive force" may be applied to the filter to effect intermittent movement of the filter. I read claim 7, as does plaintiff, to mean that a tractive force alone may be used to move the filter.

The court emphasized that "the Berlyn devices must be compared to the claims of the Kalman patent, not to a preferred, in this case, more sophisticated embodiment as described in the specification." In conclusion, the court commented on the manner in which the Berlyn devices advance the filter assembly:

That the Berlyn devices push rather than pull the filter is not a difference of enough significance to escape the charge of infringement. Defendant's employee \* \* \* testified during his deposition that it makes no difference in the Berlyn device whether the filter trays are pushed or pulled.

Turning to the issue of validity, the court noted that  
Moziek only

\* \* \* discloses a variation on the screen changer method of filtering plastic. It does not call for continuous movement of the filter; rather, as in screen changers, the change is done all at once--that is, an entire new filter is placed across the flow. Furthermore, Moziek makes no provision for a band or ribbon or any length of filter. Rather, as is typical for screen changers, two filters are called for--one being used, one being cleaned. Although Moziek teaches that the valves can be cooled to prevent leakage, the theory of the cooling is different from that in the Kalman patent. In Moziek, leakage is primarily prevented by using closely fitting metal parts. The cooling helps prevent leakage past the valves. This is vastly different from relying on the plastic itself, as in Kalman, to form plugs.

Characterizing Moziek as disclosing a sliding "screen changer" method while "the essence of the Kalman invention is the continuous filter," the court concluded that "The Moziek patent falls far short of anticipating the Kalman patent [sic, claimed invention] under 35 USC §102. \* \* \* Moziek, as written, does not teach what Kalman does." Because "specific problems not provided for by the prior art" are solved by Kalman, for example, "prevention of leakage; continuous filtering; and maintenance of constant temperature and pressure in the plastic upstream," the court also concluded that the claimed invention meets the requirement of nonobviousness under 35 USC 103.

#### 5. Arguments on Appeal.

KC argues that the district court gave the claims in issue too narrow a scope and that, properly construed, each is invalid under 35 USC 102(a), 102(b), 102(e), and/or 102(g) in view of Moziek. KC also asserts that the claims are invalid under 35 USC 102(a) (known or used by others in this country

before Kalman's date of invention) in view of evidence which shows that prior to "the effective date of invention of the Kalman patent [sic, invention], Monsanto built and operated a number of filter devices corresponding to the disclosure of the Moziek patent."

Avering that all claims are also invalid under 35 USC 103, KC states that, following its anticipation analysis, "it is clear that very little, if any, differences exist between the prior art Moziek patent and the claims at issue. The only difference is that the same filter band of the Moziek device is not in both the inlet and outlet ports at the same time. Dean Fischer [KC's expert] testified that the Kalman patent claims do not require that this be so." KC suggests that additional expert testimony compels the conclusion that the claimed invention would have been obvious within the meaning of §103 in view of Moziek taken with Garrahan, and that it was error for the court both to discard Garrahan as a relevant reference and to ignore that testimony. Moreover,

the recognition in the Curtis patent of supplying cooling coils along with the recognition that seals may be formed by cooling thermoplastic material as shown by the Joukainen et al, Welt, Thomas and Lehner patents indicates that the level of ordinary skill in this art clearly recognized the formation of seals by chilling of a hot thermoplastic.

KC concludes its arguments on validity by emphasizing that the court erred in dismissing Moziek on its belief that "the filter does not move continuously" and that "leakage of plastic is to be minimized, not used as self-sealing plugs."

KC contends that the claims do not require continuous movement

and that they only require prevention of substantial leakage. Further, it is argued, "if Moziek is discounted because leakage is primarily prevented by using closely fitting metal parts, that is precisely what the Berlyn device uses as well. \* \* \* If Moziek is discounted because the major portion of the slot is filled with the filter cartridge assembly, why shouldn't this distinction apply to the accused Berlyn device which utilizes this concept to a greater degree?"

Arguing that "Mere application of claim phraseology or a word by word correspondence is not alone enough to establish infringement"; that "the language of the claim must be read in light of the specification and the file wrapper"; that the "monopoly granted to the inventor can never be broader than the invention disclosed to the public"; and that a specification or its prosecution history "may not be used to enlarge the claim," KC contends that analysis of the actual invention Kalman regards as his "leads inescapably to the conclusion that the invention disclosed, relative to the advancement of the filter when it is desired to effect a screen change, is the concept of utilizing the internal hydrostatic pressure differential in some manner." Thus construed, KC contends the claims are not infringed. If the claims are not so construed, KC maintains here -- as it did before the district court -- they are invalid.

Kalman asserts that resolution of the issues of infringement and validity revolve around the scope of the claims, specifically, whether they must be read to include an unwritten limitation that requires movement of the filter by differential hydrostatic pressure. Noting that KC has not shown any of the

findings of the district court, including infringement, to be clearly erroneous, Kalman maintains that the court correctly answered this question in the negative, saying that the Kalman claims in issue "contain no reference to movement of the filter by hydrostatic pressure."

### Jurisdiction

Our subject matter jurisdiction over this appeal is provided by section 127(a) of the Federal Courts Improvement Act of 1982, Pub. L. No. 97-164, 96 Stat. 25, which gives this court exclusive jurisdiction of appeals from final decisions of the federal district courts if the subject matter jurisdiction of the district court was based, in whole or in part, on 28 USC 1338(a), with exceptions not relevant here. 28 USC 1295(a)(1) (1983). The district court's jurisdiction was so based.

### OPINION

#### 1. Infringement

As noted above, on Kalman's motion for summary judgment, KC failed to introduce any evidence to rebut the affidavits submitted in support of Kalman's position on the meaning of the only claim language left in dispute by the parties' stipulation regarding literal infringement. Accordingly, the district court granted the motion with respect to this issue, stating that "the linked filters in the Berlyn continuous filter devices are equivalents of the 'band or ribbon' described in the patent." It also correctly noted that because of this holding, if the claims are not read as KC wishes, it "has in effect admitted that it has infringed the patent."

KC argues that, in light of the Kalman disclosure, the independent claims must be read as limited to a process and apparatus which "[effect] movement" of a filter band or ribbon by differential hydrostatic pressure. The district court properly rejected this contention, for dependent claims 2 and 33 (not in issue) contain that very limitation,<sup>1/</sup> and it is settled and proper law that "Where some claims are broad and others narrow, the narrow claim limitations cannot be read into the broad whether to avoid invalidity or to escape infringement." Deere & Co. v. International Harvester Co., 658 F.2d 1137, 1141, 211 USPQ 11, 16 (7th Cir. 1981); Cameron Iron Works, Inc. v. Stekoll, 242 F.2d 17, 21, 112 USPQ 411, 415 (5th Cir. 1957) (cases cited); Western States Machine Co. v. S.S. Hepworth Co., 147 F.2d 345, 350, 64 USPQ 141, 146 (2d Cir. 1945) (cases cited). See Maccarone v. Pincus & Tobias, Inc., 11 F. Supp. 248, 251, 27 USPQ 104, 106-07 (ED NY 1935), aff'd mem., 82 F.2d 1015 (2d Cir. 1936).

Because the accused devices fall within the scope of the asserted claims, as interpreted, the district court's factual finding of identity of "invention," a question "chiefly to be

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<sup>1/</sup> Claim 2, which depends from claim 1, adds the limitation, "wherein the filter band or ribbon is keyed to the sealing plug within the outlet port and wherein the hydrostatic pressure of said substance within said passage acting on said sealing plug within the outlet port is utilised [sic] to move said filter band or ribbon as a result of controlled extrusion of said outlet sealing plug."

Claim 33, which depends from claims 26 and 18, adds the limitation, "wherein the outlet port presents a greater effective area to said passage than the inlet port to provide a net hydrostatic force for moving said filter through said device."

determined by comparison of the two [inventions]," was not clearly erroneous. See Coupe v. Royer, 155 U.S. 565, 579 (1895), (The Court there adopted the words of Prof. William C. Robinson's classic "work on Patents," (The Law of Patents for Useful Inventions (1890) Vol. 3, p. 378) wherein he stated that where the defendant "denies that the invention used by the defendant is identical with that included in the plaintiff's patent, the court defines the patented invention as indicated by the language of the Claims; the jury judge whether the invention so defined covers the art or article employed by the defendant."). Indeed, the stipulation by the parties, coupled with KC's failure to counter Kalman's affidavits and evidence submitted in his motion for summary judgment, dictated the conclusion of the district court.

Nevertheless, KC argues that "despite literal readability of the asserted claim language on the Berlyn filter process and device," there can be no infringement under the law because "there is no infringement of the true spirit and scope of the invention made by Kalman," citing Autogiro Co. v. United States, 384 F.2d 391, 155 USPQ 697 (Ct. Cl. 1967).

We do not agree. Because application of "reverse equivalents" is a legal question, we conclude on this record, as a matter of law, that the Berlyn devices do the same work, in substantially the same way, to accomplish substantially the same result. Id. at 399-400, 155 USPQ at 704. While a Berlyn brochure declares that its devices represent an improvement over the Kalman invention, we cannot say that Berlyn "has so far changed the principle of the device that the claims of the

patent, literally construed, have ceased to represent [Kalman's] actual invention." Westinghouse v. Boyden Power Brake Co., 170 U.S. 537, 568 (1898).

Because KC has not separately argued any claims, we affirm the finding of the district court that all asserted claims are infringed. This brings us to the remaining issue of validity.

## 2. Validity

Again, KC's principal argument is that the Kalman invention, as defined in the claims in suit, is anticipated by Moziek<sup>2/</sup> if the "effecting" and "permitting" movement language of claims 1 and 18 is not "interpreted as being the type of movement for the filterscreen which relies on a differential pressure acting on the plugs formed in the filter inlet and outlet ports to impart movement to the filterscreen device." We have stated above that such limitation may not be "read into" the claims. Hence our only remaining task is review of the district court's determination that the claims in issue are neither anticipated by Moziek, nor rendered obvious, within the meaning of 35 USC 103, by the teachings of any combination of prior art references presented by KC.

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<sup>2/</sup> Another way of putting it, which means the same thing, is that the claims in suit are anticipated; and "anticipated" means fully met within the meaning of 35 USC 102.

a. Anticipation

A party asserting that a patent claim is anticipated under 35 USC 102 must demonstrate, among other things, identity of invention. In cases like this, identity of invention is a question of fact, e.g., Coupe v. Royer, supra at 578-79, and one who seeks such a finding must show that each element of the claim in issue is found, either expressly described or under principles of inherency, in a single prior art reference, or that the claimed invention was previously known or embodied in a single prior art device or practice. Preliminary to this determination, of course, is construction of the claims to determine their meaning in light of the specification and prosecution history, which construction is a matter of law for the court.

Although the claims make no mention of continuous movement of the filter, the district court distinguished the claimed invention from Moziek on the basis that that reference

\* \* \* discloses a variation on the screen changer method of filtering plastic. It does not call for continuous movement of the filter; rather, as in screen changers, the change is done all at once--that is, an entire new filter is placed across the flow.

The court continued:

Although Moziek teaches that the valves can be cooled to prevent leakage, the theory of the cooling is different from that in the Kalman patent. In Moziek, leakage is primarily prevented by using closely fitting metal parts. The cooling helps prevent leakage past the valves. This is vastly different from relying on the plastic itself, as in Kalman, to form plugs.

Accordingly, after consideration of the Kalman and Moziek inventions, the district court concluded that "The Moziek patent falls far short of anticipating the Kalman patent," for the reason that "Moziek, as written, does not teach what Kalman does." (Emphasis ours.) Citing Illinois Tool Works, Inc. v. Sweetheart Plastics, Inc., 436 F.2d 1180, 1182-83 (7th Cir. 1971), the district court had previously emphasized that "To be an anticipation a prior patent must include all the teachings necessary to accomplish what the allegedly invalid patent succeeds in doing." (Emphasis ours.)

This was a somewhat incorrect analysis of the law of anticipation, which requires that a distinction be made between the invention described or taught and the invention claimed. The law of anticipation does not require that the reference "teach" what the subject patent teaches. Assuming that a reference is properly "prior art," it is only necessary that the claims under attack, as construed by the court, "read on" something disclosed in the reference, i.e., all limitations of the claim are found in the reference, or "fully met" by it.

While the court erred in stating that Moziek must, to anticipate, disclose the same invention as that described by Kalman, it still found that one element of the claimed invention was not disclosed in Moziek, which is enough. The court concluded that "Moziek makes no provision for a band or ribbon or any length of filter." KC has not persuaded us that this finding was erroneous. Our study of the Moziek patent confirms it.

The district court properly concluded that, while the interlocking multiple cartridge assembly found in the alleged infringing Berlyn device is, as the court had previously held on motion for summary judgment (215 USPQ at 162), equivalent to a "filter band or ribbon," the single cartridge assembly found in Moziek is not. In attempted refutation, KC points only to the following inconclusive statement made by its expert at the trial:

Well, I believe that the, that through the carriage in Moziek with the screen in the, is in the form of a band or ribbon.

Given the district court's summary judgment conclusion on the interpretation of "band or ribbon," we are unable to find clear error in the court's decision that KC did not sustain its burden of demonstrating anticipation.

b. Obviousness

The district court began its discussion of obviousness by noting the three inquiries mandated by Graham v. John Deere Co., 383 U.S. 1, 17 (1966), which inquiries are simply those required by the statute itself, 35 USC 103.

With respect to the scope and content of the prior art, the court concluded

\* \* \*that the prior art shows variations and incremental improvements on the slide screen changer for filtering thermoplastics and includes various forms of continuous filters for other media which are somewhat easier to handle than thermoplastics. However, none of the prior art reveals a way to use a continuous filter with plastics. Specific problems not

provided for by the prior art include, for instance, the problem of how to prevent leakage at the inlet and outlet ports. The step forward taken by Kalman solves several problems at once: prevention of leakage; continuous filtering; and maintenance of constant temperature and pressure in the plastic upstream.

The court next said that the level of skill in the art is determined in a number of ways and quoted the following from Malsbary Mfg. Co. v. Ald, Inc., 447 F.2d 809, 811, 171 USPQ 7, 8 (7th Cir. 1971):

\* \* \* the usual way of determining such level is by referring to the subjective reaction of a person thoroughly familiar with the particular art and, if possible, one who practiced the art at the crucial time in question.

The court then stated that "Mr. George Pickering, plaintiff's expert, is such a person, and his testimony leads me to conclude that Kalman's invention would not have been obvious to a person of ordinary skill in the art at the time of the invention. Those persons of ordinary skill simply did not see a solution to the problems inherent in filtering plastics." Finally, in support of its determination, the court stated that the "Auto-screen" devices "built under" Kalman's patent "have enjoyed commercial success. Mr. Gerald Berlyn, in fact, attempted to become a licensee for Autoscreens before he built his own machine."

Five references are listed in the Kalman patent as having been considered by the examiner. They include patents directed to an oil filter of "the filter press type"; an air filtering means, one object of which is "to provide means for continuously moving a sheet or web of filtering media across an air duct or

other passage and of sealing the edges of the same against the passage of unfiltered air and/or other gaseous body"; a continuous filter "useful in the manufacture of paints, enamels, varnishes, lacquers and the like"; an automatic fluid testing mechanism "for periodically depositing on a porous tape samples of solid particles which are filtered from measured quantities of fluids to be analyzed"; and an apparatus for filtering liquid, "and more particularly, to improved apparatus for filtering undesirable matter, impurities and the like from a liquid solvent being used for cleaning material in a dry cleaning operation or process."

As the district court pointed out, although the examiner cited the above five patents, he based no rejection on them. Indeed, he allowed the claims as filed except for a few examiner's amendments. 215 USPQ at 159. KC's principal reliance is on the patents of Moziek and Garrahan. Like the district court, we recognize they are more pertinent on the obviousness issue than the art cited by the examiner and must be carefully examined to determine whether KC has sustained the burden placed on it by 35 USC 282.<sup>3/</sup>

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<sup>3/</sup> The trial court referred to §282 as shifting the burden of proof to the party attacking validity, which is a mistake. It places it there and there it stays. It may become more or less difficult to sustain as evidence is produced, but the burden never shifts. See Chicago Rawhide Co. v. Crane Packing Co., 523 F.2d 452, 457, 187 USPQ 540, 545 (7th Cir. 1975).

Of course, where the PTO has not considered facts relevant to an issue in suit, there is no reason to give deference to its action in issuing the patent and a court may find those facts controlling in determining whether the burden of proof has been sustained. Id., F.2d at 458, 187 USPQ at 546.

The trial court gave extensive consideration to Moziek both on Kalman's motion for summary judgment and again at the trial, heard testimony about it and about a machine allegedly built according to its teachings and even heard testimony from Moziek himself. We agree with the court's appraisal of that reference as a typical screen changer type of machine with no provision for a band or ribbon.

With respect to Garrahan, the trial court put it in the same category with Moziek, and we agree. We have one minor point of disagreement which is that Garrahan was further distinguished from Kalman on the ground that it dealt only with straining rubber which the court seemed to exclude, erroneously, from the category of "thermoplastics." It is clear from Garrahan that his rubber was thermoplastic (softening with heat) since he discloses keeping it "as soft as possible during the straining" by heating it. Furthermore, Kalman's own specification refers to the filtration of "Plastics, rubber and other materials which are usually extruded." Nevertheless, the fact remains that Garrahan is no closer prior art than Moziek which specifically deals with straining "plastics."

Though there is nothing to show that these two patents were considered by the PTO, the burden of establishing facts to support a conclusion of obviousness in view of the prior art remained on KC. Solder Removal Co. v. International Trade Commission, 582 F.2d 628, 632-33, 199 USPQ 129, 132-33 (CCPA 1978).

KC points to its cross examination of Kalman's expert, and argues that his testimony reveals that "It would be obvious to combine the teaching of Garrahan, that a long filter plate extending out of a filter device could be used, with the device disclosed by Moziek." The following exchange is relied upon:

Q. So, if I saw the device I had constructed [a Moziek-type device] worked without leaking and I saw Garrahan, could I say why can't I use Mr. Garrahan's teaching with a device that Mr. Moziek taught me to build, because I know it would work?

A. What is Mr. Garrahan's teaching that you're postulating?

Q. Use of a long filter band that extends out -- out of my extruder pad or my screen changer body.

A. All right.

Q. Would that be a fair combination of the teachings of Garrahan and Moziek?

A. Well, yes, I'd say so. This is a slide changer, and that's a slide changer. Why not use this instead of that.

In other words, KC's argument is that it would have been obvious within the meaning of 35 USC 103 to open the valves of the Moziek device, leave them open, and combine it with the so-called "long filter band," which is not very long, that extends through Garrahan to arrive at Kalman's claimed devices and processes. With respect to the sealing plug claim limitations, KC suggests that the prior art "indicates that the level of ordinary skill in this art clearly recognized the formation of seals by chilling of a hot thermoplastic."

We cannot agree, however, that this is sufficient to defeat Kalman's claims. KC's arguments are directed to various

hypothetical combinations of prior art features and amount to nothing more than hindsight reconstructions. They fail to focus on other evidence respecting the nonobviousness of Kalman's claimed invention.

The district court found, based upon testimony given at trial, that several long-standing problems were solved by Kalman. At that time, the court concluded, "those persons of ordinary skill simply did not see a solution to the problems inherent in filtering plastics." Although KC responds that "None of these elements form a part of the claimed Kalman invention," it has not established that these advantageous results are not attributes of (i.e., that they have no nexus to) the claimed invention, which resides in a combination of steps or elements. Accordingly, we hold none of the findings of the district court to be clearly erroneous. Its decision holding that the claims in suit have been infringed by KC and that KC has failed to sustain its burden to show them invalid is affirmed.

AFFIRMED

UNITED STATES DISTRICT COURT  
EASTERN DISTRICT OF WISCONSIN

AUG 17 1982

PETER GABOR KALMAN,

Plaintiff,

v.

Civil Action  
No. 78-C-721

KIMBERLY-CLARK CORPORATION,

Defendant.

DECISION and ORDER

A four-day court trial in this patent validity-infringement case ended on April 2, 1982. The case was very ably presented by lead counsel for the parties, I. Irving Silverman for the plaintiff and Leonard J. Santisi for the defendant. The following constitutes my findings of fact and conclusions of law.

There are two issues in the case. One concerns the validity of the patent in suit, U.S. Patent 3,471,017. If it is valid, the second question is whether the accused Berlyn continuous filters model nos. CF3539 and CF4549 owned and used by the Kimberly-Clark Corporation infringe the patent's process claims numbered 1, 3, and 15 and its apparatus claims numbered 18, 20, 23, and 25.

The plaintiff Peter Gabor Kalman is a citizen of the United Kingdom. He resides in London, England. Kalman is the patentee and owner of the patent in suit. His corporation, Process Developments Ltd. of London, manufactures and sells filter devices constructed according to the teachings of the patent. Kalman has also licensed Mobil Oil Corporation to make and use filter devices under the patent in the United States. The filter devices sold in the United States under the patent are sold under the trademark "Autoscreen."

The defendant Kimberly-Clark Corporation of Neenah, Wisconsin manufactures, among other things, products from heat-softenable plastics which it obtains in bulk, feeds to apparatus which soften and extrude it through dies, spinnerets or the like. The heat softened plastic is filtered during the process. The end product is sheet material made of plastic.

#### The Kalman Patent

The patent in suit describes a filtering process and apparatus. It was issued on October 7, 1969 to Mr. Kalman based on an application filed June 20, 1967. The date of the invention is February 21, 1967, the filing date of Mr. Kalman's corresponding British patent application.

The Kalman patent has two independent claims, claims 1 and 18, the first directed to the method of the invention and the second to the apparatus of the invention. The invention provides a means of filtering molten plastic to remove contaminants while the plastic is being forced through a central bore toward a die or mold. The gist of the invention is the provision of a continuous filter device in the form of a "band or ribbon" for heat-softened flowing plastic.

The invention operates when a length of filter is passed across the flow of plastic. The filter is incrementally moved to bring fresh filter areas into the flow path and remove clogged filter areas from the path. Controlled temperature heat exchangers are positioned at the inlet and outlet ports through which the filter passes. The heat exchangers cause the formation of sealing plugs of rigid or semi-rigid plastic which always surround the filter ends and move with the filter. The plugs are continuously self-maintained or re-formed from the molten plastic to maintain seals as the filter moves. They

prevent leakage without the need for high pressure sealing or extremely close tolerances during the operation of the device.

In the Kalman patent the filter is a roll of unsupported filter screening. Backup support for the screening is provided by a fixed breaker plate that is built into the enclosure and through which the filtered plastic passes after it has passed through the filter.

The Kalman patent discloses examples of the means by which the filter is moved continuously into and through the inlet port, across the stream of flowing plastics, and into and through the outlet port without stopping the flow of plastics and without stopping the operation of the extruder. One of these procedures involves making the outlet port larger than the inlet port. As a consequence, the rigid or semi-rigid plug of plastic material in the outlet port is under greater hydrostatic pressure than the plug at the inlet port. Because the sealing plugs are connected to the filter, the pressure causes the plugs and filter to move together toward the outlet port. The movement slowly carries the sealing plug of the inlet port into the enclosure and expels the other one. The filter gradually moves across the stream of flowing plastics while the plastic is being filtered through the screening. The movement is accomplished without significant leakage because the sealing plugs are always being formed and maintained.

Another procedure for moving the filter ribbon involves increasing the forward movement of the filter by pulling at the emerging end of the ribbon with a direct external force. Similarly, the forwarding movement of the filter ribbon may be retarded by the application of a direct force to the ribbon at the inlet port.

Prior to the design and construction of the Berlyn devices of the type owned by the defendant, the Autoscreen devices were the only continuous filter devices available on the market.

The file history of the Kalman patent indicates no prosecution of the claims other than a minor amendment by the Examiner. With the minor amendment, the claims were allowed as filed. The application upon which the patent issued was filed with 43 claims including the independent process claim 1 and the independent apparatus claim 18. None of the claims were rejected by the Patent Office. No amendments to the application were made to distinguish the invention from an prior art. The Patent Office cited five U.S. patents in the Kalman patent application, but applied no art to the claims.

The language "band or ribbon" was never discussed or argued between the applicant and the Examiner, nor was there any discussion of the use of hydrostatic pressure for moving the filter or of the difference in size between the inlet and outlet ports. The Patent Office did not object to any of the claims in suit which do not include references to the movement of the filter by internal pressure or to ports of different sizes.

The Examiner's amendment inserted the phrase "heat-softened" before "substance," inserted the word "temperature" before "condition" and changed the word "slot" to the word "port" in Claim 1. Claim 18 was amended to insert the phrase "for filtering a heat-softened substance" after "device," to change "can be passed and" to "is passed and can be ...." and to insert after "substance" the phrase "and means to provide temperature conditions at said ports to form said plugs." The Examiner's amendment includes the statement, "The above amendments have been authorized by applicant's attorney, Mr. Leo Rosetta, via a telephone interview on January 30, 1969." The application was issued following the amendment. The amendments were made to clarify the claims, not to distinguish them from any prior art references.

### The Berlyn Filters

The accused devices, Berlyn Continuous Filters Model numbers CF3539 and CF4549 were manufactured by the Berlyn Corporation of Worcester, Massachusetts, and sold to the defendant Kimberly-Clark in 1977. They were in use prior to the filing of this lawsuit and during the pendency of the suit.

The Berlyn screen changer devices operate without stopping the extruder and without producing great variations in the back pressure of the plastic in the extruder. The accused devices have heated enclosures connected between the extruder and the dies. The enclosures have a slot or channel transverse of the plastic flow that intercepts the flow, an inlet port at one end of the channel, and an outlet port at the other end.

Each of the accused devices has a string of three trays in the channel at all times and the trays are moved from the inlet port to the outlet port under the influence of an external force, a hydraulic ram, pushing the string through the channel in small increments. Each tray is divided into small compartments separated by narrow dividers. A small rectangle of filter screening material is inserted into each of the compartments before the tray is introduced into the channel. Each tray is coupled to its neighbor so that all trays in the channel move simultaneously during the filtering process. The trays have a number of perforations which are larger than the interstices of the screen elements.

A stream of air at the ports controls the temperature so that a solidified sealing plug is maintained and re-formed as the string of trays moves through the channel. The solidified plugs surround the trays at the inlet and outlet ports and prevent the plastic from leaking out of the slots.

### The Claims

In a stipulation filed June 30, 1980, the defendant agreed that claims 1, 3, 15, 18, 20, 23, and 25 of the Kalman patent read on the accused Berlyn devices but for the description of the filter as a "band or ribbon" and "in the form of a band or ribbon." Based in part on the stipulation, plaintiff moved for summary judgment on both issues, validity and infringement. In a decision and order filed November 5, 1981, and hereby incorporated by reference into this decision, I determined that the filters used in the accused Berlyn devices were equivalents of the band or ribbon described in the patent. I also determined, however, that defendant had, although somewhat belatedly, inserted another issue into the lawsuit, thus preventing summary judgment. That issue was whether the claims of the Kalman patent must be read as limited to a method of moving the filter across the plastic by differential pressure acting on the plugs formed in the inlet and outlet ports. If so, defendant argued, because the accused devices depend on an external hydraulic ram, there could be no infringement. Defendant also argued, relying primarily on U.S. Patent 3,112,525, the so-called Moziek patent, that if the limitation is not read into the Kalman claims, the Kalman patent is invalid. Following trial, the issues remain nearly the same as they were on summary judgment. The controversy swirls around the scope of the patent claims.

### Infringement

Plaintiff asserts infringement of claims 1, 3, 15, 18, 20, 23, and 25. Infringement of Claims 4, 5, and 16 is no longer actively asserted. The allegedly infringed claims are as follows:

1. A process for filtering a heat-softened substance flowing through a passage comprising the steps of introducing a filter in the form of a filter band or ribbon by passing it through inlet and outlet ports flanking said passage so that a part of the filter extends across said passage, forcing the substance through the filter part to filter said substance whilst providing temperature conditions at said inlet and outlet ports resulting in the formation within said ports of sealing plugs of said substance of adequate rigidity to prevent substantial leakage at said ports and, when desired, effecting movement of said filter through said ports under conditions providing for self-maintenance of said sealing plugs to introduce another part of said filter band or ribbon into said passage.

3. A process as claimed in claim 1 wherein movement of said filter band or ribbon is effected intermittently.

15. A process as claimed in claim 1 in which said substance is a heat-softened plastic material.

18. A filtering device, for filtering a heat-softened substance, including a body defining a passage through which said substance can be caused to flow and slotted inlet and outlet ports flanking said passage through which a filter in the form of a band or ribbon is passed and can be moved to introduce different parts of said filter across said passage, said ports being adapted for the formation therein, in use, of sealing plugs of the substance being filtered permitting movement of said filter through said slots without substantial leakage of said substance, and means to provide temperature conditions at said ports to form said plugs.

20. A filtering device as claimed in claim 18 wherein each slotted port defines an extended channel through which said filter passes.

23. A filtering device as claimed in claim 20 including means for controlling the temperature of each port.

25. A filtering device as claimed in claim 20 wherein the channel of at least one of said ports is parallel sided over at least part of its length.

Because of the stipulation and the decision of November 5, 1981, there are limited areas of controversy on the infringement issue. It is agreed by the parties that the Berlyn devices infringe the Kalman patent except for one remaining item.

As on summary judgment, defendant asserts that the Kalman claims "must be read in light of the patent specification and thus the claimed step of 'effecting movement' must be read with the limitation that the movement is effected by differential internal hydrostatic pressure." Defendant's Proposed Findings No. 30, p. 12. Because the Berlyn device does not rely on differential pressure to effect movement, but rather uses a hydraulic ram, defendant argues that there can be no infringement.

I find that claims 1, 3, 15, 18, 20, 23, and 25 are directly infringed by the Berlyn devices. These claims contain no reference to movement of the filter by hydrostatic pressure. Method claim 1 refers merely to "effecting movement" of the filter. When one looks to other claims, it becomes clear that "effecting movement" in claim 1 does not refer to one means of moving the filter. Alternate means of effecting movement are set forth in claims 5, 6, and 7. Claim 7 states that a "tractive force" may be applied to the filter to effect intermittent movement of the filter. I read claim 7, as does plaintiff, to mean that a tractive force alone may be used to move the filter.

In determining whether an accused device infringes a patent, one must first examine the claims. If the accused device falls within a claim, infringement exists. Graver Tank v. Linde Co., 339 U.S. 605 (1950). Thus the Berlyn devices must be compared to the claims of the Kalman patent, not to a preferred, in this case, more sophisticated embodiment as described in the specifications. See: Smith v. Snow, 294 U.S. 1 (1935). Defendant cannot avoid infringement by impairing the function of one element of the preferred embodiment, especially when the less sophisticated method here is, in effect, found in one of the claims. That the Berlyn devices push rather than

pull the filter is not a difference of enough significance to escape the charge of infringement. Defendant's employee, Edward N. Ruscher, testified during his deposition that it makes no difference in the Berlyn device whether the filter trays are pushed or pulled. Thus, the Berlyn filters infringe claims 1, 3, 15, 18, 20, 23, and 25 of the Kalman patent.

#### Validity

The next issue is the validity of the patent. At the time of the invention, it was

"known art to employ two distinct filter gauges supported by separate perforated backing discs and when one becomes clogged the other is made to continue filtering. This is achieved either by redirecting the flow from one filter disc to the other by means of a valve or by incorporating the two filters and their supports in a slide which can be periodically reciprocated transversely to the flow of the plastics material. Eventually however the clogged or damaged filter discs still require replacement and this is an essentially manual operation involving work with hot and sticky objects and regular attendance by personnel. These known methods usually involve metal to metal sealing necessitating high actuating forces and the use of costly hydraulic equipment if leakage is to be minimized." Kalman Patent, Column 1, lines 54-68, emphasis added.

The Cowen patent, number 642,814, is an example of the slide screen changer known in the art prior to the Kalman invention.

One of the problems with a slide screen changer filtering device was that it could not, with sufficient speed, provide a fresh filter to the stream of material that was heavily contaminated with impurities. In recycling scrap plastic materials such as those once used by consumers, a large quantity of impurities must be removed. Plastic material that is heavily contaminated quickly clogs a filter. An increase in

pressure in the material upstream from the filter then results, requiring a constant changing of filters. The problems with slide screen changers are further described in a brochure published by the Berlyn Corporation called "Continuous Filters." Trial Exhibit #56.

The seals of a slide screen changer were usually made with metal-to-metal contacts, including a soft metal bushing. The slide screen could be pushed from one side to another with a reasonable amount of force.

In 1967 plastics were being filtered at temperatures of up to 600° Fahrenheit and at pressures of up to 5,000-6,000 pounds per square inch. Then, as now, in order to maintain a consistent product emerging from the filter, there was a need to keep the temperature and pressure of the plastic material constant.

The problems addressed by the Kalman patent were how to maintain constant temperatures and pressures, how to avoid production delays for screen changes, and how to avoid excessive leakage of the hot plastic material. Before the patented Kalman devices were made, there was no screen changer or filtering device for heat-softenable plastics that moved slowly, a little at a time, across a stream of plastic material.

Defendant argues that prior art references not before the Patent Examiner invalidate the Kalman patent. The principal reference relied on is U.S. Patent 3,112,525 (Moxiek). Defendant also relies on U.S. Patent 1,195,576 (Garrahan); U.S. Patent 2,507,311 (Lodge); U.S. Patent 3,007,199 (Curtis); U.S. Patent 2,920,347 (Joukainen); U.S. Patent 3,278,986 (Welt); U.S. Patent 3,331,101 (Thomas); and U.S. Patent 3,354,504 (Lehner). Garrahan and Curtis disclosed modified screen change devices. Garrahan is described as a rubber reclaiming machine. Lodge discloses a fixed screen filter device where the filter itself is a continuous screen. Sealing against leakage is accomplished

by clamping the filter between metal parts. However the extruder must be shut down to present a new filter to the stream of material, which is described as rubber, compounds, or the like. Joukainen discloses a seal for a rotary pump of an extruder device. Joukainen has little or no relevance to filtering.

Walt discloses a seal for a rotary pump of an extruder device. It is difficult to see the relevance of Walt to filtering. Thomas discloses double-acting screw flights to collect plastic material which leaks past the rotary shaft of an extruder. Joukainen, Walt and Thomas all require leakage of the plastic material from the seal because the material has become degraded and must not reenter the stream of plastic material. Lehner discloses a stuffing box forming a seal at the high pressure end of an extruder screw.

The Moziek patent is the one on which defendant primarily relies. Moziek discloses a process for filtering a heat-softened substance. The patent discloses a heated extruder barrel through which molten thermoplastic material flows. A slidable cartridge assembly into which a filter is placed is positioned within a slot across the flow of the plastic and against a fixed internal supporting breaker plate. At each open end of the transverse channel Moziek discloses rotatable valve assemblies. The valve assemblies are cylindrical with an intermediate segment cutout. Provision is made to rotate these valves 90°. When the valves are positioned in one position the cylindrical portion of the valves serves to seal or block the opening but when they are rotated 90° the intermediate cutout segment is aligned with the channel opening so as to permit insertion of a new filter cartridge assembly through one side and permit a dirty or clogged filter cartridge assembly to be ejected out the other side.

Moziek discloses operating the filter with the filter cartridge assembly fixed in the flow passage until the screen becomes clogged and a filter change is necessary. At this point Moziek indicates that both valve cores must be open so that a channel or slot is completely open and a new fresh filter cartridge is pushed through the slot with a retractable ram or rod. This action pushes the fresh cartridge assembly until it abuts the clogged assembly within the filter body and moves the new cartridge into the flow passage while forcing the clogged assembly out of the outlet port. After this is completed, Moziek discloses closing the valves until the next filter change is required. In the disclosure, the filter change occurs while the extruder keeps operating so that there is no interruption in the extrusion process. However, the inventor, John Moziek, testified that the machines built according to his specifications by the Monsanto Corporation were stopped for filter changes to avoid the excessive leakage which otherwise occurred.

The description of the valves which are closed when the Moziek device is in operation, includes a method of circulating a cooling medium in order to prevent leakage past the valves.

I find that the Moziek patent discloses a variation on the screen changer method of filtering plastic. It does not call for continuous movement of the filter; rather, as in screen changers, the change is done all at once--that is, an entire new filter is placed across the flow. Furthermore, Moziek makes no provision for a band or ribbon or any length of filter. Rather, as is typical for screen changers, two filters are called for--one being used, one being cleaned. Although Moziek teaches that the valves can be cooled to prevent leakage, the theory of the cooling is different from that in the Kalman patent. In Moziek, leakage is primarily prevented by using closely fitting

metal parts. The cooling helps prevent leakage past the valves. This is vastly different from relying on the plastic itself, as in Kalman, to form plugs.

Defendant built a model screen changer, demonstrated at trial (Exhibit 073), which it claims was constructed in accordance with the teachings of the Moziek patent. The machine was constructed in 1981 in the factory of the Berlyn Corporation. Plaintiff objected to the demonstration at trial; the exhibit was received subject to my determination as to weight. I find, as indicated below, that the demonstration has very little probative value. The machine, constructed in 1981, with adjustments made in 1982, is not constructed under the teachings of the Moziek patent. At best it is a hybrid machine, constructed by use of as much of the Moziek patent as possible, but with tremendous overlays of knowledge acquired subsequent to Moziek and, more tellingly, subsequent to the Kalman disclosures.

The machine differs significantly from the teaching of the Moziek patent. The Moziek machine is to be run with the valves closed; in the demonstration the valves were open. In Moziek the filter is not a long filter extending through the valves--indeed, how could it be if the valves are to remain closed. In Moziek, the filter does not move continuously, rather the screens are changed all at once. In Moziek leakage of plastic is to be minimized, not used as self-sealing plugs as in the demonstration. Defendant claims that it made only minor modifications to Moziek to arrive at the demonstration machine. I find that those modifications were not minor; they were ~~not~~ not innovations taught by the Kalman patent.

Although a patent is presumed valid under 35 U.S.C. § 282, the presumption is not conclusive. St. Regis Paper Co. v. Benis Co., 549 F.2d 833 (7th Cir. 1977); cert. den., 434 U.S. 833. It shifts the burden of proof to the party attacking the

validity of the patent. Republic Industries, Inc. v. Schlage Lock Co., 592 F.2d 963 (7th Cir. 1979). It is stated, however, that the presumption does not exist in the face of prior art not before the Patent Office. Republic Industries, supra, Chicago Rawhide Mfg. Co. v. Crane Packing Co., 523 F.2d 452 (7th Cir. 1975); cert. den., 423 U.S. 1091. In order to weaken the presumption, the prior art references, cited to the district court must be more pertinent than those cited by the Examiner. Varco, Inc. v. Moore Business Forms, Inc., 440 F.2d 580 (7th Cir. 1971); cert. den., 404 U.S. 873. Defendant argues that the patents cited above, especially Moziek, Garrahan, Curtis and Lodge, are more pertinent to the claimed invention of the Kalman patent than the prior art references cited but not applied by the Patent Office. Defendant's argument with regard to the prior art cited by the Examiner is that it is not relevant to the Kalman invention because it does not deal with filtering thermoplastic material. I must note that the same could be said of Garrahan and Lodge, which on their face deal with straining rubber products.

The citations to prior art in the Kalman patent include statements regarding the prior art in Column 1 of the patent in which is detailed the problems inherent in screen changers. The patent explains in Columns 1 and 2 that the purpose of the invention is to overcome the problems by use of a band or ribbon of filter and to make use of the "temperature dependent viscoelastic properties of the materials ... being filtered." Through the language in Column 1 regarding previous methods of filtering plastics, the Examiner was made aware of previous patents on machines to filter plastics. Moziek and Curtis are simply variations on the many machines in which an attempt is made to filter thermoplastic material while effecting screen changes without interfering with production.

Moziek, as glossed by defendant, is of course much more pertinent than any of the prior art citations. However, Moziek, as written, without benefit of defendant's hindsight, recedes in significance to its value as another example of a slide screen changer, whose presence on the scene is acknowledged at Column 1 of the Kalman patent.

The essence of the Kalman invention is the continuous filter. It seems clear to me that the relevance of the prior art cited by the Examiner was that the patents cited involved continuous filters. To a degree greater than the prior art cited by the defendant, Nickle, U.S. Patent 2,218,453; Doubleday, U.S. Patent 2,675,129; Avery, U.S. Patent 3,138,015; and Beduhn, U.S. Patent 3,310,172 are relevant to the essence of the invention. They all involve means of continuous movement of a filter so as to afford continuous filtration.

Even assuming, however, that Moziek and/or the other citations relied on by defendant overcome the presumption of validity, defendant has not shown that the Kalman invention is invalid under 35 U.S.C. § 102 or § 103.

The Moziek patent falls far short of anticipating the Kalman patent under 35 U.S.C. § 102. To be in anticipation a prior patent must include all the teachings necessary to accomplish what the allegedly invalid patent succeeds in doing. Illinois Tool Works, Inc. v. Sweetheart Plastics, Inc., 436 F.2d 1180 (7th Cir. 1971). As explained above, Moziek, as written, does not teach what Kalman does. Defendant does not contend that any of the other prior art citations are an anticipation of the Kalman patent.

The Kalman patent is not invalid for obviousness under 35 U.S.C. § 103. When a determination under § 103 is to be made:

"... the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue and are to be ascertained; and the level of ordinary skill in the pertinent art resolved." Graham v. John Deere Co., 383 U.S. 1, 17 (1966).

Looking to the first criterion, I conclude that the prior art shows variations and incremental improvements on the slide screen changer for filtering thermoplastics and includes various forms of continuous filters for other media which are somewhat easier to handle than thermoplastics. However, none of the prior art reveals a way to use a continuous filter with plastics. Specific problems not provided for by the prior art include, for instance, the problem of how to prevent leakage at the inlet and outlet ports. The step forward taken by Kalman solves several problems at once: prevention of leakage; continuous filtering; and maintenance of constant temperature and pressure in the plastic upstream.

The level of skill in the art is revealed in a number of ways. In Malsbary Mfg. Co. v. Ald, Inc., 447 F.2d 809 (7th Cir. 1971), the court stated that:

"... the usual way of determining such level is by referring to the subjective reaction of a person thoroughly familiar with the particular art, and if possible, one who practiced the art at the crucial time in question."

Mr. George Pickering, plaintiff's expert, is such a person, and his testimony leads me to conclude that Kalman's invention would not have been obvious to a person of ordinary skill in the art at the time of the invention. Those persons of ordinary skill simply did not see a solution to the problems inherent in filtering plastics.

After an initial analysis regarding obviousness is made, Graham, supra, at 17 and 18, indicates that secondary factors may be considered:

"Such secondary considerations as commercial success, longfelt but unsolved needs, failure of others ..."

The autoscreen devices, built under the Kalman patent, have enjoyed commercial success. Mr. Gerald Berlyn, in fact, attempted to become a licensee for Autoscreens before he built his own machines.

Finally, the United States Court of Appeals for this circuit has recently made an observation which is particularly relevant to the defense of obviousness in this case. In L. E. Sauer Machine Co. v. Corrugated Finishing Products, 210 U.S.P.Q. 81, 83 (7th Cir. 1981), it stated:

"The courts must take care not to conclude that an invention is obvious because it has become obvious by hindsight."

#### Conclusion

Defendant's argument in this case is that the patent must be read to include a requirement for movement of the filter by differential pressure. So read, defendant argues, the patent is not infringed, but read without the requirement the patent is invalid for obviousness. The argument is undoubtedly clever and if the premise is accepted, defendant wins either way. However, my examination of the evidence convinces me that the argument rests on faulty premises and, like all such arguments, must fail.

The Kalman patent does not require movement of the filter by differential pressure, rather differential pressure is used in the preferred embodiment of the invention. Thus, the Berlyn devices infringe the patent. It does not follow that the patent is invalid. The patent takes great steps beyond the prior art, including Moziek, and by itself, sets forth solutions to several of the problems inherent in filtering heat-softened plastic.

In accordance with this decision, counsel for the parties are directed to confer and, if possible, agree on what further proceedings will be necessary to bring this case to its conclusion in this court. Both counsel are to submit a report within 30 days outlining their view of further proceedings. SO ORDERED.

Dated at Milwaukee, Wisconsin, this 17  
day of August, 1982.

BY THE COURT:

  
TERENCE T. EVANS  
UNITED STATES DISTRICT JUDGE

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UNITED STATES DISTRICT COURT

CLERK

EASTERN DISTRICT OF WISCONSIN

PETER GABOR KALMAN,

Plaintiff,

v.

Civil Action  
No. 78-C-721

KIMBERLY-CLARK CORPORATION,

Defendant.

DECISION and ORDER

Plaintiff Peter Gabor Kalman, owner of U.S. Patent 3,471,017, has moved for summary judgment establishing (1) that the Berlyn continuous filter machines owned by defendant Kimberly-Clark Corp. and used in their Meenah, Wisconsin plants infringe Claims 18, 20, 23, and 25 of his patent; (2) that the process used by the same machines infringes Claims 1, 3, and 15 of his patent; and (3) that the patent is valid.

U.S. Patent 3,471,017 teaches a filtering process and apparatus for filtering molten plastic to remove contaminants while the plastic is being forced toward a dye or mold. It includes both apparatus and method claims and was issued October 7, 1969, to Mr. Kalman, the inventor. In the device a length of filter is continuously moved across an enclosure through which the melted plastic is flowing. The movement insures that a fresh filter is placed in the path of the flow and that the clogged filter is removed. At the entrance and exit of the filter's pathway are control temperature heat exchangers which solidify the plastic at that point and form seals to prevent leakage of melted plastic. Diagrams in plaintiff's brief filed March 19, 1981 are useful in envisioning the process.

Mr. Kalman is a citizen of the United Kingdom who resides in London, England. Kalman has licensed Process Devel-

opments Ltd. of London to manufacture and sell the filter devices throughout the world, including the United States. The devices are sold in the United States under the trademark "Autoscreen." Plaintiff has also licensed Mobil Oil Corp. to make and use devices as described in the patent.

Kimberly-Clark is a Delaware corporation with a place of business in Neenah, Wisconsin, in the Eastern District of Wisconsin. It manufactures products from heat softenable plastics by using a device called the Berlyn continuous filter, Model Nos. CF3539 and CF4549, manufactured by the Berlyn Corp. of Worcester, Massachusetts. Kimberly-Clark used these devices prior to the filing of this lawsuit. It has continued to use them during the pendency of the lawsuit, with the defense being financed and conducted by Berlyn.

Other undisputed facts as presented by the plaintiff and accepted for purposes of the motion by the defendant are the following. A publication of the Berlyn Corp. (Ex. MSJ-4) is an illustrated advertising brochure which explains the operation of the accused devices. The brochure refers to plaintiff's patent and commercial devices embodying the plaintiff's patent. Although plaintiff has not been permitted access to Kimberly-Clark plants to view the accused devices in operation, photographs have been taken by the defendant and have been represented as truly depicting the accused devices and the filter trays and filter medium used in the devices (Ex. MSJ-7).

Defendants also agree that the file history of the patent (Ex. MSJ-11) shows that the patent application was allowed as filed with all claims and with minor Examiner's amendment of the claims. The language "band or ribbon" was never discussed or in controversy during the prosecution of the patent application. The U.S. Patent Office cited five U.S. patents in the application, but applied none of them to the claims.

Defendant has stipulated (Ex. MSJ-2) that method Claims 1, 3, and 5 of the patent as well as Apparatus Claims 18, 20, 23, and 25 read on the accused device and method but for the description of the filter as being "in the form of a band or ribbon."

It is also undisputed that prior to Kalman's invention filtering was done by screenholders or screenchangers. In one type the screen was placed in a holder that crossed the flow of the plastic and which required that the plastic flow be stopped and the apparatus cooled before the screen element could be changed. Another type included two screenholders and a slider. One screen would cross the flow of the plastic. When that screen became clogged, the other screen would be forced across the channel into the flow. This device operated much like the familiar old slide projector. According to plaintiff, disadvantages are apparent in both devices. The first required shutting down the production line, and the second was difficult to operate, required careful surveillance, and had to be manually changed when the filter became clogged. Both devices leaked excessively because of the back pressure of the plastic.

Both the Kalman device and the Berlyn continuous filter operate without stopping the extruder or producing great variations in the pressure of the plastic in the extruder. The patented device involves a long screen which is drawn across the path of the plastic. The Berlyn filters have a string of three trays in the screenchanger at all times, moving in very small timed increments across the flow of plastic. The trays are divided into small compartments separated by narrow dividers. There is a filter screen element in each compartment that is carried across the flow of plastic. The trays are coupled together and move as a unit without coming apart through the filter enclosure. At the entrance and exit of the slots through which the screens move are air-cooled heat exchangers that are adjusted to provide cool

plugs to prevent leakage of the molten plastic. Both plugs are continuously renewed as the filters move through the enclosure.

In resisting the motion for summary judgment, defendant emphasizes that in patent cases, in which it is necessary for the court to consider expert testimony to translate and interpret material and technical facts, summary judgment should be approached with trepidation. Citing Advanced Hydraulics, Inc. v. Otis Elevator Co., 525 F.2d 477 (7th Cir. 1975).

Even approaching the motion with trepidation in that case, however, the court of appeals affirmed the district court's granting of the motion. In Research Corp. v. Nasco Industries, Inc., 501 F.2d 358 (7th Cir. 1974), the court indicated that on the issues before me, infringement and validity, summary judgment should be entertained in a proper case:

"There is nothing in Rule 56 to forbid the use of summary judgment procedures to determine whether a genuine issue of fact exists, concerning the factual foundation for determination of the ultimate issue of law: obviousness. Although care must be exercised to assure that controverted fact issues are not ignored, see Tee-Pak, Inc. v. St. Regis Paper Co., 491 F.2d 1193 (6 Cir. 1974), '... a suit concerning the validity of a patent over the prior art is not immune from disposition on motion for summary judgment even though, in addition to prior art patents, deposition testimony of the applicant and affidavits are involved, if no genuine issue of material fact is present.' A R Inc. v. Electro-Voice, Inc., 311 F.2d 508, 511 (7 Cir. 1962). 'Further, it is well settled that, in a proper case, the validity of a patent may be determined by use of summary judgment.' Technograph Printed Circuits, Ltd. v. Methode Electronics, Inc., 356 F.2d 442, 446 (7 Cir. 1966), cert. denied 384 U.S. 950, 86 S.Ct. 1570, 16 L.Ed.2d 547 (1966)."

Summary judgment is appropriate, the court goes on to state, in instances "where the structure and mode of operation of the accused device may be readily comprehended by the court and compared with the patent without need of technical explanation by expert witnesses." At 362.

One of the difficulties presented by summary judgment motions in patent cases is determining whether the moving party, whose burden it is, has established that no material facts are in dispute. If the subject matter is technical, it is difficult for a court, without the benefit of hearing expert testimony, to make that initial determination. Because of that difficulty, plaintiff has requested oral argument on this motion. That request is being denied, however, as my study of the moving papers convinces me that though the determination is difficult, the result would not be different after oral argument than it is here.

A patent is presumed valid (35 U.S.C. § 282) and the burden of establishing invalidity by clear and convincing evidence is on the defendant. 35 U.S.C. § 282; Helms Products v. Lakeshore Mfg. Co., 227 F.2d 677 (7th Cir. 1955); Reese v. Elkhart Welding and Boiler Works, Inc., 447 F.2d 517 (7th Cir. 1971). A patent may be invalid because it is anticipated in a prior art reference or because it is obvious. 35 U.S.C. 102 and 103. Before a determination of obviousness can be made, a court must determine the scope and content of the prior art, the difference between the prior art and the claims at issue, and the level of ordinary skill of a person in the pertinent art. Graham v. John Deere Co., 383 U.S. 1 (1966).

For summary judgment to be appropriate as to the patent's validity, then, no factual dispute must exist as to these rather amorphous issues. Determining the proper result on summary judgment becomes more difficult, in my view, when the movant seeks a finding of validity rather than invalidity. For invalidity, it might be easy to judge that the patent at issue and one or two citations to prior art are so similar that no dispute as to material facts could exist. A finding of invalidity in such a case would be appropriate. When the movant seeks a judgment of validity, however, a judge is required to determine whether a

genuine issue is presented, and that determination requires an understanding of the context of the invention -- the state of the art.

Here, defendant argues that a certain patent, in this case the Mosiek patent (U.S. Patent No. 3,112,525), describes a device in which very little plastic is lost as the filter is moved. On the other hand, plaintiff states that the invention it teaches could not operate as disclosed due to the excessive leakage of hot, high pressure plastic. To determine whether that difference of opinion presents a genuine issue of material fact, to say nothing of what the significance of those facts is, requires expert testimony. I find that it would be improper to grant summary judgment in this case on the issue of the patent's validity.

The issue of infringement also presents the preliminary problem of determining whether facts are in dispute.

Plaintiff argues that any differences between the Berlyn continuous filter devices and the autoscreen device made under plaintiff's patent are insignificant and do not prevent a finding of infringement. Defendant, on the other hand, argues that there are two ways in which the Berlyn device differs from the autoscreen, and that on the basis of these differences there is no infringement. One of the differences perceived by the defendant is that the continuous filter "in the form of a band or ribbon" is not present in the Berlyn filter. Rather the latter uses discrete separable filterplates pushed end to end through the filter device. They have been described as linked as railroad cars. The second difference defendant perceives is in the method of moving the filter across the plastic flow.

On the issue of the "band or ribbon," plaintiff has presented lengthy affidavits of two experts. One, John S. O'Brien,

an attorney specializing in patent law, after much discussion of the devices in question, concludes:

"Defendant's filter formed of inter-connected portions 1A, 1B and 1C. . . satisfies the foregoing requirements of the patent for a filter band or ribbon and, therefore, constitutes a 'filter band or ribbon,' in my opinion."

The other expert, George E. Pickering, an engineering consultant in plastics and plastics machinery, concludes, again after lengthy analysis:

"I have said above that I consider that both devices have a band of filter material so that the language which has been alleged to signify a difference namely a 'band or ribbon' as opposed to a side by side alignment of filters to me does not define a difference that has any strength at all." MSJ-16, p. 25.

In addition, plaintiff has presented testimony of Richard M. Peterson (MSJ-5), Edward H. Ruscher (MSJ-8), and Carl Sherman (MSJ-13), employees of the defendant, all of whom conceded that the accused screen structure was the same as a band or a train connected end to end moving through the apparatus.

Defendant presents no affidavits or other documents which controvert this testimony. Rule 56(e) of the Federal Rules of Civil Procedure provides:

"When a motion for summary judgment is made and supported as provided in this rule, an adverse party may not rest upon the mere allegations or denials of his pleading, but his response, by affidavits or as otherwise provided in this rule, must set forth specific facts showing that there is a genuine issue for trial. If he does not so respond, summary judgment, if appropriate, shall be entered against him."

On the basis of defendant's failure to controvert the evidence presented by the plaintiff, I conclude that no facts are in dispute on the issue of the band or ribbon. On the basis of the facts which are in the record, I conclude that nothing in the prosecution of the patent requires a limitation on the meaning of those words. I also conclude that the filters used in the Berlyn

devices are equivalents of those described in the patent. See Graver Tank & Manufacturing Co. v. Linde Air Products Co., 339 U.S. 605 (1950).

At least as to Claim 1, however, defendant perceives a second difference between the devices:

"Briefly, it is defendant's position that the limitation in Kalman patent claim 1 which recites 'effecting movement of said filter through said ports under conditions providing for self-maintenance of said sealing plugs' must be interpreted as being the type of movement for the filterscreen which relies on a differential pressure acting on the plugs formed in the filter inlet and outlet ports to impart movement to the filterscreen element. The accused devices do not utilize this feature to effect movement of the filterscreen element. Instead, the accused devices rely on an external hydraulic ram pushing on the combined filter-filterscreen support to incrementally advance the filter through the device. Since the meaning of the words in a claim must be determined with reference to the specification as a whole. . . and the monopoly granted the inventor can never be broader than the disclosed invention, . . . it follows that a clear factual issue is present regarding the disclosure of the Kalman patent at issue."

Therefore, the argument goes, there is no infringement.

Plaintiff argues that this theory is new to the lawsuit and therefore presented in an untimely manner. In any case, plaintiff argues, the scope of a patent claim is a question of law.

I am somewhat bewildered by defendant's argument. Through the stipulation previously referred to (MSJ-2), defendant has agreed that the Serlyn devices have a structure, which literally reads on the modified form of the patent claims but for the words "band or ribbon." Defendant has stipulated that its devices literally read on the words "effecting movement of said filter through said port under conditions providing for self-maintenance of said sealing plugs to introduce another part of said filter . . . into said passage." It would seem that the time for raising

an issue as to these words was when the stipulation was entered into. In any case, however, defendant has presented no expert evaluation of the phrase. Furthermore, plaintiff points out that in Column 6, lines 53 through 58 of the patent, reference is made to the fact that "the forwarding movement may be caused or increased by pulling at the emerging end of the ribbon."

Defendant's response to all of this is that "despite the fact that the literal words of the stipulated amended patent claims 'literally reads on' the accused machines, that the patent claims when read in conjunction with the disclosure of the patent and as limited by the prior art must be given an interpretation which precludes a finding of infringement."

To support this argument, defendant presents the affidavit of Leonard Santisi. The affidavit itself presents problems. Santisi is principal trial counsel in this case, not an expert witness. In addition, his affidavit is conclusory. He briefly discusses the effect of the prior art, specifically the Moziek patent, but does not detail what information in the "disclosure of the patent" requires the result defendant seeks.

As to the Moziek patent, defendant seems to be saying that if the claim is not read as limited, then the patent is invalid. I might add, if it is not read as limited then defendant has in effect admitted that it has infringed the patent. Because I have declined to rule here on the validity of the patent, the issue will almost inevitably be presented at trial. Therefore, nothing is gained by a ruling here on the scope of the claim as to the movement of the filter through the plastic. Therefore, plaintiff's motion for summary judgment will be denied in part and granted in part. The finding on which plaintiff has prevailed is that the linked filters in the Berlyn continuous filter devices are equivalents of the "band or ribbon" described in the patent.

IT IS THEREFORE ORDERED that plaintiff's motion for summary judgment is denied in part and granted in part.

IT IS FURTHER ORDERED that local counsel appear for a brief conference with the court to discuss further proceedings in this case on December 10, 1981, at 8:30 a.m.

Dated at Milwaukee, Wisconsin, this 5 day of November, 1981.

BY THE COURT:



TERENCE T. EVANS  
UNITED STATES DISTRICT JUDGE

United States Court of Appeals for the Federal Circuit

PETER GABOR KALMAN,  
Appellee,

No. 83-540  
Dist. Ct. No. 78-C-721

v.

KIMBERLY-CLARK CORPORATION,  
Appellant.

Judgment

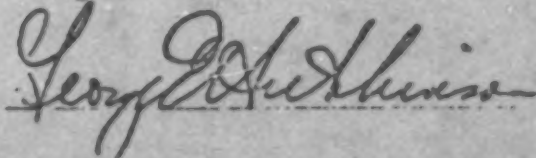
*ON APPEAL from the U.S. Dist. Court for the Eastern Dist. of Wisconsin*  
*This CAUSE having been heard and considered, it is*  
*ORDERED and ADJUDGED: AFFIRMED.*

DATED July 19, 1983

Petition for rehearing and  
suggestion for rehearing  
en banc; rehearing Denied,  
suggestion for rehearing  
en banc Declined,  
September 20, 1983.

ENTERED BY ORDER OF THE COURT

George E. Hutchinson, Clerk



Clerk

ISSUED AS A MANDATE: September 29, 1983

COSTS: Appellant

Printing Costs-----\$129.22

Total-----\$129.22

United States Court of Appeals for the Federal Circuit

PETER GABOR KALMAN,  
Appellee,

v.

KIMBERLY-CLARK CORP.,  
Appellant.

No. 83-540

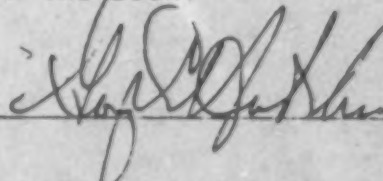
ORDER

A petition for rehearing and a suggestion for rehearing en banc having been filed in this case,

UPON CONSIDERATION THEREOF, it is Ordered by the court that the petition for rehearing be, and the same is hereby, Denied.

The suggestion for rehearing en banc is declined.

FOR THE COURT

  
CLERK

September 20, 1983

Date

cc: Irving Silverman  
Leonard J Santisi

JUDGMENT ON DECISION BY THE COURT

United States District Court

FOR THE

SEP 27 1982

EASTERN DISTRICT OF WISCONSIN

CIVIL ACTION FILE NO. 78-C-721

PETER GABOR KALMAN

vs.

PARTIAL  
JUDGMENT

KIMBERLY-CLARK CORPORATION

consideration

This action came on for ~~XXXXXX~~ before the Court, Honorable

TERENCE T. EVANS

United States District Judge, presiding. ~~XXXXXX~~

~~XXXXXX~~ and a decision having been duly rendered,

It is Ordered and Adjudged (1) Claims 1,3,15,18,20,23 and 25 of plaintiff's United States Letters Patent No. 3,471,017 are valid.  
(2) Defendant, by its use of the accused Model Nos. CF3539 and CF4549 Berlyn Continuous Filters, has infringed claims 1,3,15,18,20,23 and 25 of United States Letters Patent No. 3,471,017.  
(3) The Court's decision and order of August 17, 1982, is hereby incorporated herein as the Findings of Fact and Conclusions of Law pursuant to Rule 52, FRCP.  
(4) Pursuant to Rule 54(b), FRCP, the court finds that there is no just reason for delay for the entry of this judgment.

Approved as to form:

  
United States District Judge


Dated at Milwaukee, Wisconsin

this day

of 1982

SOFRON B. NEDILSKY

Clerk of Court

By   
Deputy Clerk

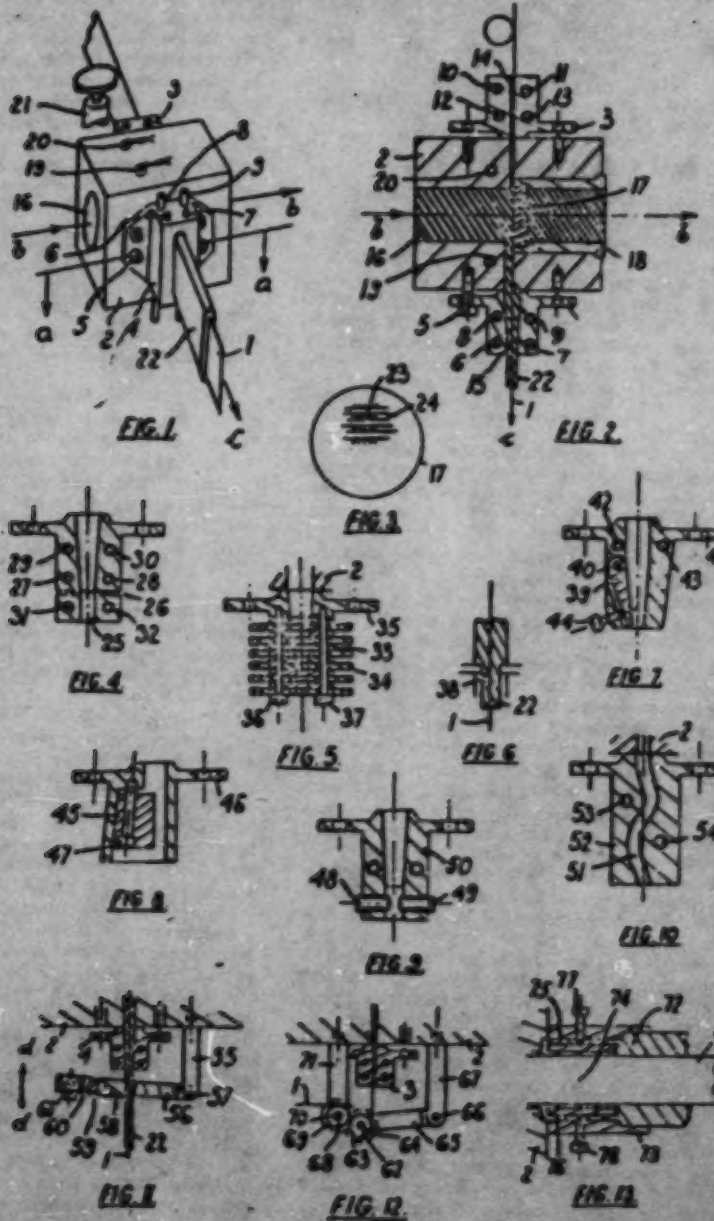
Oct. 7, 1969

P. G. KALMAN

3,471,017

FILTERING PROCESS AND APPARATUS

Filed June 20, 1967



INVENTOR  
PETER GABOR KALMAN  
BY  
*Bacon & Thomas*  
ATTORNEYS

1

3,471,017  
**FILTERING PROCESS AND APPARATUS**  
Peter Gaber Kuhn, 51 Compton Gardens,  
London NW, 6, England  
Filed June 26, 1967, Ser. No. 647,435  
Claims priority, application Great Britain, Feb. 21, 1967,  
8,123/67  
Int. Cl. B014 35/18  
U.S. Cl. 210-71 43 Claims

## ABSTRACT OF THE DISCLOSURE

Process and apparatus for filtering heat-softened plastics materials by introducing a filter ribbon across a passage through which said material flows, the filter being passed through slotted inlet and outlet ports flanking said passage and conditions being maintained at said ports resulting in the formation of solidified sealing plugs of said material in said ports which yet permit continuous or intermittent movement of said filter ribbon across said passage to renew the used part of the filter without substantial leakage of plastics material.

This invention relates to a process and apparatus for filtering a substance flowing through a passage by the introduction of a filter across such passage and is particularly but not exclusively concerned with the filtering of heat-softened plastics materials.

The extrusion process, in which heat-softened plastics materials are extruded through a die by screw or ram, is the starting process for a number of forming methods employed in the manufacture of plastics articles. In the presence of impurities in the raw materials it becomes necessary to purify these materials before further processing and this is usually carried out by straining the thermally softened plastics through a disc of stainless steel filter cloth incorporated into an extruder. During such filtering a disc of wire cloth of suitable mesh size, often a laminate of several such cloths, is supported on a perforated backing plate within the stream of hot, softened plastics material between the screw or ram and the die of an extruder; in time this disc becomes clogged with impurities and must be replaced. The opening up of a hot extruder in order to effect replacement of the filter screen interrupts production and is of considerable inconvenience to operating personnel during the accompanying manual extraction of the clogged filter; when still hot it presents risks of scalding and when cold it is oriented into position by solidified plastics material and has to be laboriously hacked out to permit its replacement with a fresh screen.

To alleviate the difficulties inherent in this cumbersome operation it is known art to employ two distinct filter gauzes supported by separate perforated backing discs and when one becomes clogged the other is made to continue filtering. This is achieved either by redirecting the flow from one filter disc to the other by means of a valve or by incorporating the two filters and their supports in a slide which can be periodically reciprocated transversely to the flow of the plastics material. Eventually however the clogged or damaged filter discs still require replacement and this is an essentially manual operation involving work with hot and sticky objects and regular attendance by personnel. Three known methods usually involve metal to metal sealing necessitating high actuating forces and the use of costly hydraulic equipment if leakage is to be minimized.

The present invention seeks to overcome these disadvantages by utilizing a filter ribbon or band of extended length passing through the flow path of the material being filtered by transverse thermal inlet and exit seals

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which make use of the temperature-dependent visco-elastic properties of the materials—such as polyolefins, for example polyethylene—being filtered. This method permits gradual replacement of the clogged filter screen areas with fresh filter areas of the same ribbon either continuously or in steps; in either case no interruption of the extrusion process is occasioned with particularly beneficial consequence when extrusions of considerable lengths and uniformity are manufactured such as tubing or plastics covered cable, where even short interruptions cause the rejection of large quantities of the product. The method requires no manual digging-out of spent filters from their enclosures, both the introduction of fresh filtering zones and the simultaneous ejection of the spent filtering zones forming an automatic process requiring little attention and no physical effort. Additionally, the considerable hydrostatic pressure present within an extruder causes no sealing difficulties, such as those which arise with the known methods, but can be turned to good advantage by providing the driving force required for forwarding the filter ribbon through the extruder.

Generally, the invention consists in a filtering enclosure through which an extended ribbon of filter screen passes and in two slotted sealing ports which are situated at the inlet and exit zones of the filter ribbon respectively. It is typically, though not necessarily, situated between the screw and the die of a plastics extruder and forms a part of the flowpath of the hot plastics material which is extruded.

The enclosure containing the hot plastics melt is maintained at an elevated temperature appropriate to imparting to the melt the comparatively moderate viscosity required for the filtering and extrusion processes but the mean temperature within the operative sections of the sealing ports are kept within a lower temperature range and the quantities of rigid and semi-rigid plastics material situated within the channels of these ports act as self replacing sealing plugs at the entry and exit zones of the filter ribbon. The movement of one of these plugs through its sealing port depends on the hydrostatic pressure of the melt, on the force exerted on the plug by the filter ribbon passing through or beside it and is particularly dependent also on the shape, curvature and aperture size of the passage within the sealing port through which the plug passes and also on the temperature distribution and the corresponding visco-elastic and adhesive properties established within the plug and at its boundaries. All these conditions influence the formation of and speed at which the plastics plug passes through the sealing port which contains it and can be employed, singly or in combination, to control its movement. The filter screen may advantageously be embedded in the plug at the exit side and in this case the rate at which the screen is changed within the filtering enclosure can be easily regulated by controlling the rate of extrusion of the plastics plug which, in this case, forwards it.

With reference to the appended drawings, FIG. 1 shows a general arrangement of a preferred embodiment of the invention, FIG. 2 represents a section through this embodiment as seen in the direction of arrows a—c, FIG. 3 shows the construction of a breaker plate, viewed in the direction of arrows b—d, forming a part of the embodiment shown in FIGS. 1 and 2; FIGS. 4 to 10 show sectional views of alternative embodiments of a sealing port suitable for forming part of the embodiment of the invention described, viewed in the direction of arrows e—g, FIG. 11 shows an auxiliary forwarding device suitable for use with the invention, FIG. 12 shows an auxiliary retarding device adapted for use with the invention and FIG. 13 shows a sectional view taken in the plane

of the filter ribbon of a further embodiment of a sealing port suitable for forming part of the embodiment shown in FIGS. 1 and 2 viewed in the direction of arrows b-b.

With reference to FIGS. 1 and 2, filter ribbon 1 passes through filtering enclosure 2 by way of sealing ports 3 and 4, held onto the enclosure by means of bolts, one of which is shown at 5. Outlet port 4 is provided with cartridge heaters 6 and 7 and also with water cooling channels 8 and 9; similarly inlet port 3 is provided with cartridge heaters 10 and 11 and with water cooling channels 12 and 13. Ribbon 1 enters enclosure 2 through a slot 14 in the inlet port 3 and leaves it through the tapered slot 15 in the exit port 4 and is forwarded in the direction of arrow c. Ports 3 and 4 are substantially similar except for the entry slot 14 which is parallel sided and of narrower width than the exit slot 15. Heat softened plastic material passes through bore 16 in enclosure 2 in the direction of the arrows b-b and passes through filter ribbon 1 which is supported on breaker plate 17 held in sleeve 18. Cartridge heaters 19 and 20 are provided for heating the filtering enclosure 2. A movement sensing device 21 is provided at the inlet side to sense the forwarding movement of ribbon 1 through the filtering enclosure 2. A solidified plastics liner 22 forms around ribbon 1 at the exit side and contains the impurities removed from the melt by the filtering process. Filtering enclosure 2 is maintained by heaters 19 and 20 at a steady elevated temperature appropriate to the requirements of the extrusion and filtering processes for the material concerned, for example 160° C. for an average low density polyethylene. Inlet port 3 and outlet port 4 are made of a material of high thermal conductivity, for example beryllium copper and are generally maintained at about room temperature by a suitable coolant such as water flowing through channels 8, 9, 12 and 13. Ports 3 and 4 are provided with raised lips where they abut against filtering enclosure 2 so as to minimize heat flow from the enclosure 2. Whilst this condition is maintained solid plastics plugs are formed within ports 3 and 4 which seal the filtering enclosure at both sides and prevent movement of ribbon 1. The latter is forwarded through the filtering enclosure in steps by periodically shutting off the water supply to ports 3 and 4 by means of a valve, not shown, and by raising the temperatures of these ports by means of the cartridge heaters 6, 7, 10 and 11. As the outer skins of the substantially solid plastics plugs within ports 3 and 4 gradually soften ribbon 1 becomes free to move. Since the cross-sectional area of exit slot 15 is larger than that of inlet slot 14 and since both plugs are still keyed onto ribbon 1 a net hydrostatic force exists which forwards ribbon 1 in the direction of arrow c together with the two plugs. Exit slot 15 narrows in the direction of movement so that the plastics plug contained within it must change its shape as it squeezes through, taking ribbon 1 with it. This deformation is dependent, among other factors, particularly strongly on the heat supplied to the plugs and therefore the rate of forwarding can be conveniently controlled by regulating the heat input to ports 3 and 4. At the inlet side slot 14 in the inlet port 3 contains only enough plastic material around or beside ribbon 1 to provide a pressure seal; when port 3 is at a raised temperature the inlet plug softens and offers little resistance to the forwarding pull. When the movement sensing device 21—which may consist of a friction wheel carrying a circular mole grating or some other known device as used in numerical movement control—registers that ribbon 1 has been forwarded by a pre-set amount heating of ports 3 and 4 is discontinued and their water supply is reestablished. Owing to the high thermal conductivity of the material, for example beryllium copper, of which ports 3 and 4 are made the plastics plugs within them specify re-solidify and movement of ribbon 1 is arrested almost immediately. The forwarding movement is set so as not to exceed the length of slot 15 in port 4 and is generally a fraction of the diameter of the bore

16. When both entry and exit plugs have fully re-solidified ribbon 1 may be indexed forward again by reheating ports 3 and 4. The repetition rate may be preset by using a suitable timer or alternatively ribbon 1 may be forwarded whenever a pressure transducer of a known type, installed upstream of ribbon 1, indicates a rising pressure due to excessive clogging-up of the filter. It will be readily appreciated that the sealing plugs within slots 14 and 15 need not necessarily be heated by means of cartridge heaters but that any other readily controllable heating means may be employed; for example a heating current may be passed through the filter ribbon 1 itself if it is made of a material of suitable electrical conductivity such as Nichrome wire cloth, or alternatively heat may be supplied to ports 3 and 4 by circulating a suitable heat transfer medium such as Silicone oil through apertures provided in these ports. Ribbon 1 is preferably made of Dutch weave stainless steel wire cloth which has superior filtering properties and is supported over a breaker plate 17 which is preferably of the slotted construction shown in FIG. 3. A multitude of rectangular windows such as 23 are formed in this plate by two sets of interpenetrating slots, one slot being shown at 24, cut into the plate at right angles to each other, one set from each face with the slots adjoining ribbon 1 oriented parallel with the direction of forwarding the latter so as to offer minimal resistance to movement. It will be clear that laminate structures may also be employed as filter ribbons should, for example, strength considerations so require.

It will be readily seen by those skilled in the art that the invention lends itself also to continuous rather than periodic operation; in this method of operating the invention ports 3 and 4 are maintained at intermediate temperatures which facilitate the required slow but continuous forwarding of ribbon 1 through the apparatus. As in this mode of operation the material contained in the exit wedge 15 has more time to melt in depth it becomes desirable to augment its pressure sealing action by the addition of a further thermal sealing zone. An alternative embodiment of an exit port in accordance with the invention which is particularly suitable for continuous filter screen changing is shown in FIG. 4. This embodiment is provided with an additional, substantially parallel walled outer sealing zone 25 permanently maintained at a temperature lower than that of the remainder of the sealing port and accordingly this zone contains almost fully solidified material which as a resilient sliding plug and assists in preventing the ingress of semi-molten material. The narrow wail 26 serve to minimize heat flow between the tapered and the parallel walled sections of the exit port which are maintained at different temperatures by means of the cartridge heaters 27 and 28, by heat conducted from enclosure 2 and by coolant flow in channels 29, 30, 31 and 32. For example, in a typical filtering and extrusion run with a low density polyethylene material during which the pressure in the filtering enclosure was 4000 p.s.i. and the temperature 150° C., the inlet port was maintained at 80° C., the inner wedge-shaped part of the exit port at 110° C. and the outer, parallel walled sealing zone of the exit port at 45° C.; the filter ribbon was forwarded at a steady speed of 0.42" per hour. It will be clear that the desired temperature profile along the exit port may be maintained also by external convection cooling or by the use of the other means in themselves of known art which can serve for maintaining preset temperatures. FIG. 5 shows a cross section of an exit port of laminated construction along which the desired temperature profile is maintained by heat conduction from enclosure 2 and by convection cooling of exposed face. The port is made up from alternate laminations of poor conductivity such as ceramic sheet 33 interspersed with protruding laminations of high thermal conductivity such as beryllium copper sheet 34, bolted together and to a flanged base 35 by means of bolts 36 and 37; heat conduction from enclosure 2 is limited as desired

by the ceramic spacer sheets such as 23 and convection cooling of the protruding high conductivity fins may be augmented by means of a fan, not shown. It will be seen that the tapered zone of the exit slot, in which the plastics material undergoes deformation, controls the speed of filter screen forwardly while the colder, parallel zone acts as a pressure seal and maintains the high extrusion pressure present within enclosure 2 and that these may equally well follow each other in reverse order. Furthermore such a reversed arrangement may also be combined with that shown in FIG. 4, resulting in a sealing port in which two parallel, preferably watercooled end sections are joined by a transition section of diminishing aperture size whose controlled temperature governs the forwarding rate of the filter ribbon.

It will be appreciated that the scope of the invention is not limited to plastics filtering but that apparatus built in accordance with the invention can be employed also for filtering other materials as long as they are capable of solidification when cooled so that substantially pressure tight sealing plugs can be formed of the material to be filtered within the sealing ports. When a liquid having a well defined solidification temperature is filtered in apparatus in accordance with the invention, such as for example water, then the rate of filter ribbon forwarding depends primarily on the rate at which the outer skins of the initially solid sealing plugs, consisting for example of ice, melt into a liquid state incapable of supporting stresses other than hydrostatic pressure thus permitting the still solid cores of these plugs to traverse the channels within the sealing ports. The choice of coolant circulating within channels 8, 9, 12 and 13 in FIGS. 1 and 2 is clearly dependent on the melting temperature of the sealing plugs and the coolant is so chosen that it remains solid at the lowest temperatures reached within the apparatus. When substances are filtered in apparatus according to the invention which lose their fully solid consistency more gradually on heating then the mechanism whereby the plugs within the sealing ports control the forwarding speed of filter ribbon 1 is believed to be predominantly that of visco-elastic strain relaxation. Plastics, rubber and other materials which are usually extruded, invariably possess a somewhat wide transition zone within which the strain release rate and the corresponding rate of overall deformation are controlled by temperature dependent visco-elastic relaxation. As the gradual extrusion of the semi-solid plug within the exit port is believed to be accompanied by laminar shear awakened within the plug at least in part by interface drag generated at the walls of the exit channel and relaxing in time at a temperature controlled rate, hence surface adhesion between the plug and the exit port may also be expected to play a part in determining the forwarding rate of the plug and hence of the filter ribbon. It will be seen by those skilled in the art of the extrusion process that exit port channels other than that of the simple tapered section shown at 15 in FIG. 2 can perform a similar function and control the rate of filter ribbon forwarding provided only that the exit channel is of a geometry such that the passage of the semi-rigid plug along it awakens visco-elastic stresses and corresponding strains within the plug which relax in a temperature and time dependent manner. For example, a localized obstruction such as the constriction shown at 38 in FIG. 6 suffices to slow down the forwarding of a visco-elastic, near-solid plastics plug substantially and in conjunction with temperature control in the critical region of the constriction may be used to control the forwarding rate. Regardless of theory of operation, it is observed that when the filter ribbon is forwarded in apparatus according to the invention by allowing the extrusion pressure of the melt to act on inlet and exit plugs of unequal cross sectional areas the rate of forwarding is strongly dependent on the temperature of at least one of the plugs and this temperature may then be regulated so as to afford control over the rate of filter ribbon forwarding.

It will be obvious that a similarly effective way of operating the invention consists in altering the geometry of both ports 3 and 4 or at least of one of them and controlling the rate of filter ribbon forwarding in this manner without the necessity of temperature changes. An example of an exit port in accordance with the invention and embodying such variable geometry is shown in FIG. 7 where the port is provided with a gate 39 which is pivoted by means of pin 40 to frame 41; the port is kept at a suitable constant temperature by coolant flowing in channels 42 and 43 and the rate of filter ribbon forwarding may be controlled by adjusting screw 44 which determines the inclination of gate 39. Alternatively, as shown in the further example given in FIG. 8, a sliding wedge 45 may be employed which restricts the exit passage within frame 46 to an adjustable extent as defined by the setting of Allen screw 47 which secures it to frame 46. A further embodiment of an exit port of simple but adjustable geometry is shown in FIG. 9 where grub screws 48 and 49 carried in frame 50 plough grooves of adjustable depths into the semi-rigid plastics plug passing between them which carries ribbon 1, not shown in this figure, embedded within it.

The examples of alternative sealing ports which are suitable for forming part of apparatus embodying the invention achieve a controlled forwarding rate of the sealing plug by varying the temperature of the plug or by altering the aperture cross section or by relying on both measures simultaneously. An alternative embodiment in which retardation of the plug is brought about by changing its curvature is shown in FIG. 10. It will be seen that as the semi-rigid plastics plug traverses the wavy slot 51 in part 52 the curvature at a given locality within the moving plug undergoes changes so that bending stresses are produced within it. These stresses are brought about by the hydrostatic pressure exerted on the plug by the melt and their rate of relaxation, here governed by the balance of heat inflow from enclosure 2 and the adjustable heat outflow through the coolant channels 53 and 54 determines the rate of filter screen changing. It will be clear that this rate could also be controlled by utilizing an inlet or exit port of variable curvature operating at a suitable constant temperature. It will be understood that whilst the various examples of sealing port construction shown in FIGS. 3 to 10 serve to illustrate the way in which exit ports of various types according to the invention may be used to afford control of the filter forwarding speed, the same considerations apply also to the inlet port which may be equally readily employed to control the rate of filter screen forwarding provided only that the inlet channel within the inlet port permits sufficient controlled outward leakage to allow continual replenishment of the material forming the inlet sealing plug.

The rate at which ribbon 1 is forwarded in any of the embodiments of the invention described may be further influenced where desirable by causing direct external forces to act on the ribbon; for example the forwarding movement may be caused or increased by pulling at the emerging end of ribbon 1. One simple way of achieving this is shown in FIG. 11 where filtering enclosure 2 supports bracket 55 to which toggle frame 56 is pivoted by means of pin 57 is urged against the solidified plastics sleeve 22 surrounding ribbon 1 by leaf spring 58, which is fastened to frame 56 by means of screw 61, and grips the sleeve against one side of the frame 56; if the latter is reciprocated in the direction of arrows 6-6 the sleeve, by means of a pneumatic cylinder then sleeve 22 will be gripped and forwarded, then released in turn. In this embodiment of the invention the primary function of exit port 4 is that of providing a thermal pressure seal around ribbon 1 in accordance with the invention and its temperature is advantageously so adjusted that the forwarding thrust produced implements that provided by the toggle linkage; i.e. the rate of forwarding is not allowed to fall as low as otherwise might be

offered to the forwarding pull of the toggle. Similarly the forwarding movement of ribbon 1 may be retarded rather than enhanced by the application of a direct force to ribbon 1 by, for example, a pair of knurled gripper rollers situated on the inlet side as shown in FIG. 12. One gripper roller 63 carrying gear 63 is rotatably mounted by shaft 64 on toggle arm 65 which is pivoted by pin 66 to support 67 carried by enclosure 2. A second gripper roller 68 carrying gear 69 is rotatably mounted by shaft 70 on support 71 also carried by enclosure 2; the sum of the diameters of capstan rollers 62 and 68 plus twice the thickness of the filter ribbon 1 gripped between them is arranged to slightly exceed the sum of the pitch circle diameters of the gears 63 and 69 so that ribbon 1 is firmly gripped as the gears then mesh with a small clearance. Both the inlet and exit channels 14 and 15 may, in this embodiment, be of a simple parallel design the latter having a greater cross sectional area so that a net forwarding hydrostatic force is acting on ribbon 1, the rate of forwarding the latter may then be set as desired by braking at least one of the shafts 64 or 70 in any suitable manner so as to retard the ribbon or by regulating the speed at which the capstans allow the ribbon to enter inlet port 3.

The forwarding force acting on ribbon 1 may be controlled also by varying the hydrostatic thrust exerted on the exit plug by the melt, for example in a manner as shown in FIG. 13. In this embodiment of the invention an exit port according to FIG. 4 is employed but the outer parallel section is extended beyond the edges of filter ribbon 1; FIG. 13 shows a view of this enlargement as seen in the direction of arrows *b-b*. The extended parallel walled outer sealing zone 72 which here has an increased cross-sectional area is kept cold enough, at least near the vicinity of the outer end of the exit block 73, to ensure satisfactory sealing and the inner, tapered section 74 is maintained at a higher mean temperature as described earlier. Near molten material at the high pressure of the melt is supplied to the extension through channels 75 and 76 from enclosure 2; the ingress of plastics material can be controlled by means of the blocking screws 77 and 78 so that control over the forwarding rate of ribbon 1 is facilitated.

In the embodiment of the invention shown in FIGS. 1 and 2 filter ribbon 1 traverses filtering enclosure 2 substantially at right angles to the direction of the flow of the plastics melt. It will be appreciated that if the inlet and exit ports are spaced in the direction of this flow and filter ribbon 1 passes obliquely across enclosure 2 then the effective filtering aperture will be enlarged and the pressure drop across the filter will be minimized.

Economy in the consumption of filter cloth may be achieved by using an endless, recirculating filter ribbon loop; the impurities are filtered out as in the preceding embodiments of the invention and the surrounding solidified plastics material forming the sleeve 12 may be continuously removed, together with the entrapped impurities for example by melting or by solvent extraction.

It will be appreciated by those skilled in the art that the examples given merely illustrate, by no means exhaustively, the numerous ways in which the invention may be applied; the essential feature of the invention being that the filter is provided in the form of an extended ribbon which passes through a filtering enclosure cooled by partially or fully solidified end plugs formed of the material which is being filtered. Replacement of the clogged filter areas and removal of the impurities from the stream of the material being filtered is achieved by a substantially transverse movement of the filter ribbon. This may most simply be brought about by utilizing the hydrostatic pressure present in capstans but may also be caused, enhanced or retarded by direct mechanical pull at either end of the ribbon. It will be readily seen that the scope of the invention is not limited to extruders or to plastic materials but embraces the filtering of other

substances in the substantially fluid state which are capable of sufficient substantially fluid state which are capable of sufficient thermal solidification to effect a satisfactory seal. It will be clear also that the cross section of the filter ribbon 1 need not be of a flat rectangular shape but may be wavy or channel shaped or of any other configuration as best suited to the individual filtering application concerned. Furthermore heat insulating gaskets may be introduced between the ports 3, 4 and enclosure 2. Such gaskets may be of polytetrafluoro ethylene.

I claim:

1. A process for filtering a heat-softened substance flowing through a passage comprising the steps of introducing a filter in the form of a filter band or ribbon by passing it through inlet and outlet ports flanking said passage so that a part of the filter extends across said passage, forcing the substance through the filter part to filter said substance whilst providing temperature conditions at said inlet and outlet ports resulting in the formation within said ports of sealing plugs of said substance of adequate rigidity to prevent substantial leakage at said ports and, when desired, effecting movement of said filter through said ports under conditions providing for self-maintenance of said sealing plugs to introduce another part of said filter band or ribbon into said passage.

2. A process as claimed in claim 1 wherein the filter band or ribbon is keyed to the sealing plug within the outlet port and wherein the hydrostatic pressure of said substance within said passage acting on said sealing plug within the outlet port is utilised to move said filter band or ribbon as a result of controlled extrusion of said outlet sealing plug.

3. A process as claimed in claim 1 wherein movement of said filter band or ribbon is effected intermittently.

4. A process as claimed in claim 1 wherein movement of said filter band or ribbon is effected continuously.

5. A process as claimed in claim 1 including regulating the temperature of at least one of said sealing plugs to effect intermittent movement of said filter.

6. A process as claimed in claim 2 including regulating the temperature of at least said outlet sealing plug to effect intermittent movement of said filter.

7. A process as claimed in claim 1 including applying a tractive force to said filter at exit from said outlet port to effect movement thereof.

8. A process as claimed in claim 7 wherein said tractive force is applied intermittently to effect intermittent movement of said filter.

9. A process as claimed in claim 2 including applying a retarding force and to said filter to control movement thereof.

10. A process as claimed in claim 9 including applying a retarding force sufficient to prevent movement of said filter and intermittently relaxing said force for intermittent movement of said filter.

11. A process as claimed in claim 2 including varying the hydrostatic force acting on said outlet sealing plug to control the rate of movement of said filter.

12. A process as claimed in claim 2 wherein movement of said filter band or ribbon is effected continuously and including regulating the temperature of at least one of said sealing plugs to control the rate of movement of said filter.

13. A process as claimed in claim 2 wherein movement of said filter band or ribbon is effected continuously and including controlling the rate of movement of said filter by varying the geometry of at least one of said ports.

14. A process as claimed in claim 13 including varying the aperture size of said outlet port to control the rate of movement of said filter.

15. A process as claimed in claim 1 in which said substance is a heat-softened plastic material.

16. A process as claimed in claim 2 in which said substance is a heat-softened plastic material.

17. A process as claimed in claim 1 wherein said filter is provided as an endless ribbon loop and including cleaning said filter part after movement through said passage and recirculating said cleaned filter loop.

18. A filtering device, for filtering a heat-sensitive substance, including a body defining a passage through which said substance can be caused to flow and slotted inlet and outlet ports flanking said passage through which a filter in the form of a band or ribbon is passed and can be moved to introduce different parts of said filter across said passage, said ports being adapted for the formation therein, in use, of sealing plugs of the substance being filtered permitting movement of said filter through said slots without substantial leakage of said substance, and means to provide temperature conditions at said ports to form said plugs.

19. A filtering device as claimed in claim 18 including a perforated breaker plate disposed in said passage to provide a downstream support for said filter band or ribbon.

20. A filtering device as claimed in claim 18 wherein each slotted port defines an extended channel through which said filter passes.

21. A filtering device as claimed in claim 20 wherein said channel of at least one port is locally constricted.

22. A filtering device as claimed in claim 21 wherein said constriction is provided by at least one adjustable protrusion extending into said channel.

23. A filtering device as claimed in claim 20 including means for controlling the temperature of each port.

24. A filtering device as claimed in claim 20 wherein the channel of at least one of said ports is of wavy form.

25. A filtering device as claimed in claim 20 wherein the channel of at least one of said ports is parallel sided over at least part of its length.

26. A filtering device as claimed in claim 20 wherein the channel of said outlet port narrows at least along a part of its length in the direction of filter movement.

27. A filtering device as claimed in claim 20 wherein said outlet port channel has a parallel sided section and a section which narrows in the direction of filter movement.

28. A filtering device as claimed in claim 27 including means for cooling the parallel sided section and means for heating the narrowing section of said channel.

29. A filtering device as claimed in claim 28 including a neck between the two sections to limit heat transfer therebetween.

30. A filtering device as claimed in claim 28 wherein the parallel sided section is farthest from said passage.

31. A filtering device as claimed in claim 23 wherein said channel defining ports are formed separately from

said passage-defining body and including heat-insulating gaskets between said ports and said body.

32. A filtering device as claimed in claim 23 wherein said cooling means comprises coolant channels and said heating means comprises electric heaters.

33. A filtering device as claimed in claim 26 wherein the outlet port presents a greater effective area to said passage than the inlet port to provide a net hydrostatic force for moving said filter through said device.

34. A filtering device as claimed in claim 33 including means for controlling the temperatures of said sealing ports.

35. A filtering device as claimed in claim 33 including means for varying the aperture size of at least one of said ports.

36. A filtering device as claimed in claim 18 wherein at least one sealing port is assembled from alternate parts made of materials of dissimilar thermal conductivities facilitating the establishment of a predetermined temperature gradient along the port.

37. A filtering device as claimed in claim 18 including means for applying traction to the filter at exit from said outlet port.

38. A filtering device as claimed in claim 37 wherein said traction-applying means is a gripping device.

39. A filtering device as claimed in claim 37 wherein said traction-applying means is a capstan device.

40. A filtering device as claimed in claim 33 including means for applying a retarding force to said filter to regulate movement thereof through said device under said net hydrostatic force.

41. A filtering device as claimed in claim 33 including means for varying the effective area of one of said ports to vary the net hydrostatic force acting on said filter.

42. A filtering device as claimed in claim 33 wherein said means for varying the aperture size includes an adjustable side wall of said channel.

43. A filtering device as claimed in claim 33 wherein said inlet port channel is parallel sided.

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SAMIH N. ZAHARNA, Primary Examiner

U.S. Cl. X.R.

210-77, 179, 184, 387, 264-327

**Dec. 3, 1963**

J. MOZIEK

**3,112,525**

# APPARATUS FOR EXTRUDING THERMOPLASTIC MATERIAL

Filed Sept. 20, 1961

5 Sheets-Sheet 1

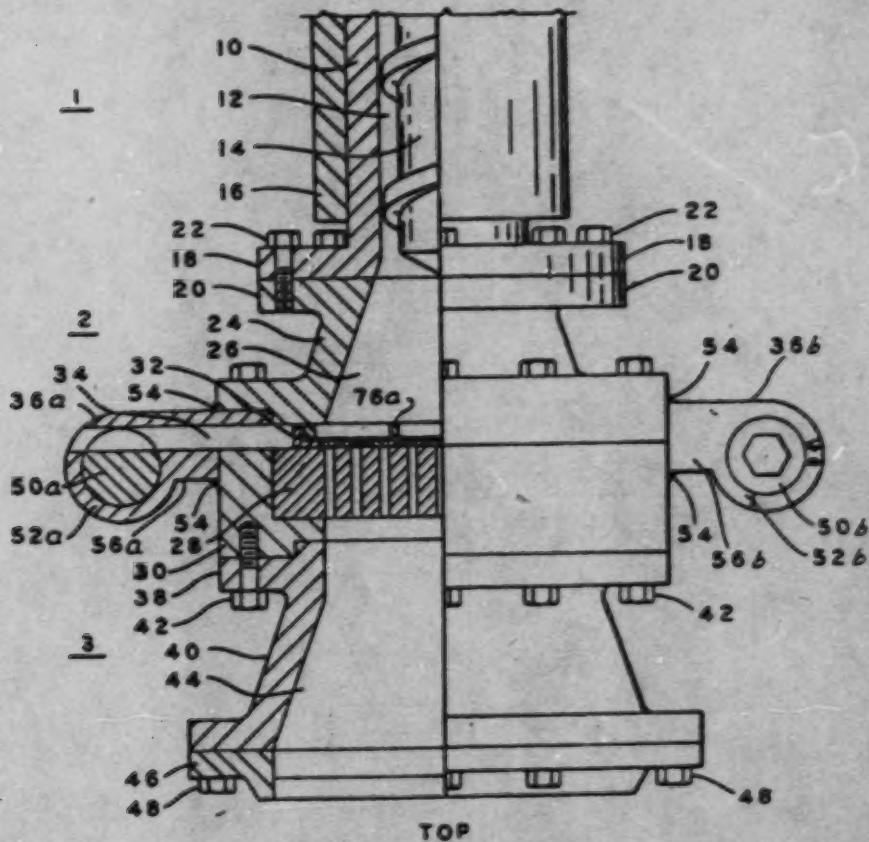


Fig. I

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AGENT

Dec. 3, 1963

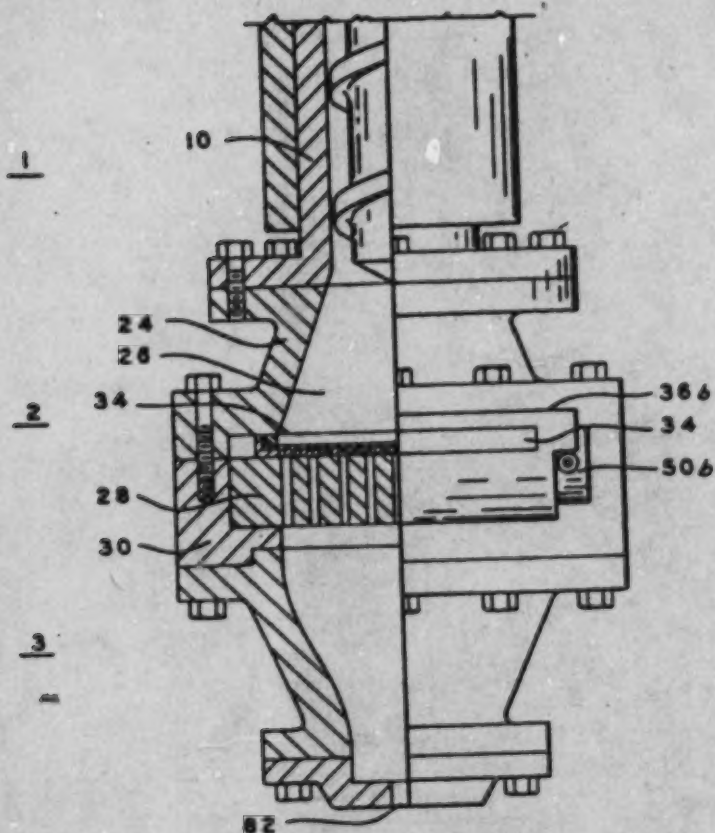
J. MOZIEK

3,112,525

APPARATUS FOR EXTRUDING THERMOPLASTIC MATERIAL

Filed Sept. 20, 1961

5 Sheets-Sheet 2



SIDE

*Fig. II*

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APPARATUS FOR EXTRUDING THERMOPLASTIC MATERIAL

Filed Sept. 20, 1961

5 Sheets-Sheet 3



Fig. III

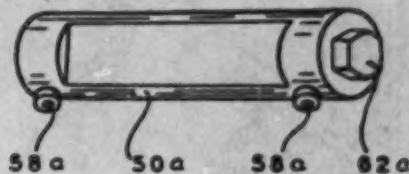


Fig. IV

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Dec. 3, 1963

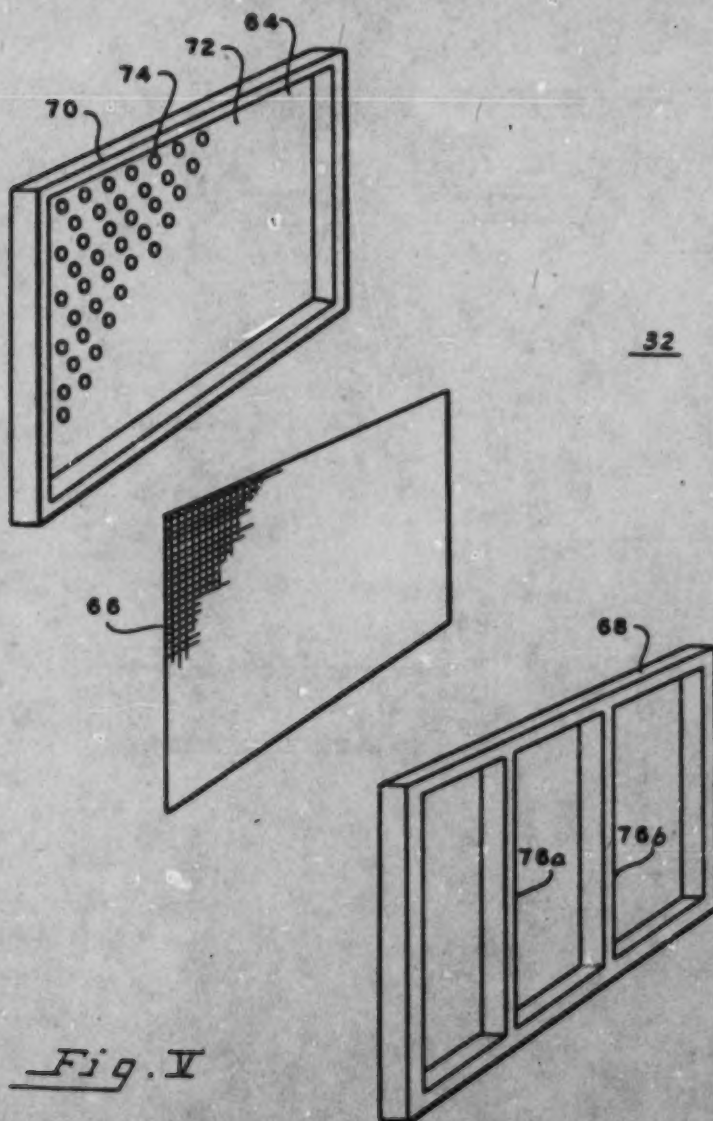
J. MOZIEK

3,112,525

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Filed Sept. 20, 1961

5 Sheets-Sheet 4



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3,112,525

APPARATUS FOR EXTRUDING THERMOPLASTIC MATERIAL

Filed Sept. 20, 1961

5 Sheets-Sheet 5

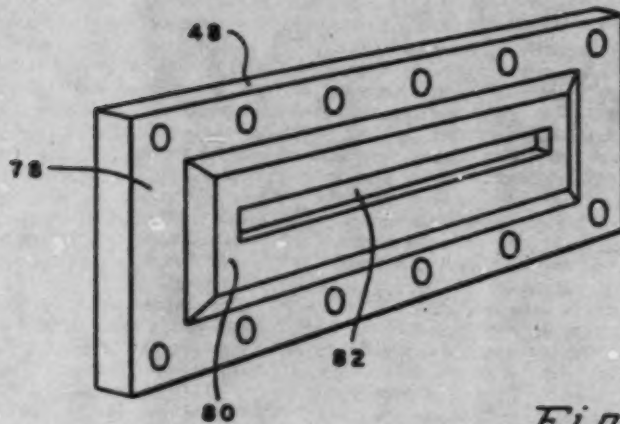


Fig. VI

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3,112,525

## APPARATUS FOR EXTRUDING THERMOPLASTIC MATERIAL

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Filed Sept. 28, 1961, Ser. No. 139,477

4 Claims. (Cl. 18—12)

This invention relates to apparatus for the continuous extrusion of thermoplastic materials. More particularly, this invention relates to an extruder having mounted thereon a fixed breaker-plate operated in conjunction with a slidable cartridge assembly that can be replaced without interrupting continuous extrusion operations.

Conventional extruders for thermoplastic materials comprise, generally, an elongated hollow casing provided with heating means and a driven rotatable screw mounted in the casing to force thermoplastic material therethrough. The discharge end of the casing is normally closed with a separate unit or "head" that is removably fixed to the body of the casing. A die is fixed to the head for shaping the thermoplastic material.

In operation, the thermoplastic material is usually fed to the extruder in a solid granular condition alone or in physical admixture with plasticizers, colorants, fillers, etc. As the thermoplastic material is forced through the casing by the screw it is heated to a plastic condition and, while plastic, is colloided and blended with such additives as may be present in order to form a homogeneous composition.

It is common practice to mount a breaker-plate assembly intermediate the screw and the die in order to build up back pressure in the casing and in order to remove impurities from the thermoplastic material being extruded. A breaker-plate normally comprises a metal plate provided with a plurality of openings through which the thermoplastic material flows. The size of the openings will determine the resistance to flow and hence, the amount of back pressure that is built up in the casing. When screens are used, back pressure can be controlled with reasonable accuracy by varying the number of screens, the mesh of the screens or both. Such screens serve an additional function in removing impurities from the thermoplastic material being extruded. The impurities are retained on the screens however and this necessitates rather frequent replacement of clogged screens.

Because of the high pressures generated within the casing, the conventional practice has been to mount the breaker-plate assembly in the interior of the extruder in a recess milled in the inner surface of the casing or head. With this construction it is necessary to interrupt extrusion operations and remove the head in order to gain access to the interior of the extruder to install or replace a breaker-plate assembly. When continuous extrusion operations are interrupted, thermoplastic material in the casing is frequently overheated and decomposed. As a result, it is preferable to avoid the interruption of continuous extrusion operations whenever possible.

A breaker-plate assembly designed for installation or replacement without interrupting continuous extrusion operations is shown and described in U.S. Patent 2,771,636. Although this system has advantages over the more conventional modes of practice, there are several problems associated with its performance. In particular, the major problem has been excessive leakage during normal running and especially during screen changes which result in flow interruptions and extruder stoppages. In addition, the rather heavy and bulky breaker-plate assembly tends to make cleaning difficult and lengthy and requires high power equipment to move or change the breaker-plate

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assembly. Finally, partial disassembly of the unit, i.e., removal of the end plugs, is required before a change can be made.

Accordingly, an object of the present invention is the provision of an extruder for thermoplastic materials including a fixed breaker-plate operated in conjunction with a slidable cartridge assembly that can be installed or replaced without interrupting continuous extrusion operations.

Another object is the provision of an extruder for thermoplastic materials including a fixed breaker-plate operated in conjunction with slidable cartridge assembly that can be removed and replaced by another slidable cartridge assembly of similar construction without interrupting continuous extrusion operations.

A further object is the provision of an extruder for thermoplastic materials including a fixed breaker-plate operated in conjunction with a slidable cartridge assembly and means for minimizing leakage of said thermoplastic materials during normal operation and particularly during screen changes without interrupting continuous extrusion operations.

The manner in which these and other objects are attained will be apparent from the following description and the accompanying drawings illustrating a preferred embodiment of the invention wherein:

FIG. I is a top plan view, partly in section showing a preferred fixed breaker-plate and a slidable cartridge assembly connected to the discharge end of an extruder;

FIG. II is a side view, partly in section showing the fixed breaker-plate and slidable cartridge assembly connected to the discharge end of the extruder;

FIG. III is an exploded perspective view of the preferred valve means used for sealing the ends of the cartridge slot;

FIG. IV is an exploded perspective view of an alternate construction of a valve core for cooling the valve means;

FIG. V is an exploded perspective view of the slidable cartridge assembly shown in FIG. I; and

FIG. VI is an exploded perspective view of the discharge section.

Referring in detail to the figures of the drawings and more specifically to FIG. 1, there is schematically shown the discharge end of the extruder 1, the fixed breaker-plate and slidable cartridge assembly 2, and a die assembly 3. The discharge end of the extruder 1 includes a casing 10 defining a bore 12 of circular cross-section in which a screw 14 of any suitable construction is rotatably mounted. Any suitable means is provided for heating thermoplastic material in the bore 12 such as, for example, an insulated electric heating coil 16 surrounding the casing 10. The fixed breaker-plate and slidable cartridge assembly 2, is fixed to the discharge end of the extruder by any suitable means, this being conveniently accomplished by providing a flange 18, on the end of casing 10 to which a similar flange 20 is fixed by means of a plurality of screws or bolts 22. The fixed breaker-plate and slidable cartridge assembly 2 includes a casing 24 defining a chamber 26, a fixed breaker-plate 28, having a central perforate cross-section coextensive with the abutting cross-section of chamber 26, securely mounted in a casing frame 30, a slidable cartridge assembly 32 positioned in slot 34, and valve means 36a and 36b for opening and closing the ends of slot 34. The die assembly 3, is fixed to the discharge end of casing frame 30 by any suitable means, this being conveniently accomplished by providing a flange 38 on die casing 40 which is fixed to casing frame 30 by means of a plurality of screws or bolts 42. The die assembly includes die casing 40 defining a chamber 44 and a die discharge section 46 fixed to die casing 40 by means of a plurality of screws or bolts 48.

In accordance with the present invention, a fixed

breaker-plate and slidable cartridge assembly 2 is used for building up back pressure in the chamber 26 and the bore 12 and for screening impurities and uncolloided agglomerates from the thermoplastic material intermediate the end of the screw 14 and the die discharge section 46. In the illustrated embodiment of the invention (see both FIGS. I and II), chamber 26 is shown to be of progressively changing circular cross-section being of minimum cross-section at the plane of abutment with the casing 10 and of maximum cross-section at the plane of abutment with the fixed breaker-plate 23. However, the cross-section of the chamber 26 at the plane of abutment with the fixed breaker-plate 23 can be of varied shape such as square, rectangular or the like and can be greater or less in area than the cross-section of the chamber 26 at the plane of abutment with the casing 10. The fixed breaker-plate 23 as shown in FIG. I and FIG. II is of substantially square cross-section, with a central perforate portion coextensive with the abutting cross-section of chamber 26. However, the cross-sectional configuration of the fixed breaker-plate 23 may be varied to any desired shape as long as the limiting boundaries of said configuration completely encompass the limiting boundaries of the cross-sectional area of the slidable cartridge assembly at the plane of abutment with the fixed breaker-plate 23.

The slot 34 should extend completely through the side of the extruder and valve means 34a and 34b, and should be of uniform cross-section throughout and should perpendicularly intersect the entire peripheral edge of the chamber 26 at the zone of intersection therewith. The slot 34 can be of any desired cross-sectional shape, such as circular, elliptical, square, rectangular, etc. In the illustrated embodiment of the invention, as shown in FIGS. I and II, the slot 34 is milled in the discharge end of the casing 24 and is of rectangular cross-section. In this showing, the slot 34 is centered with respect to the chamber 26 and perpendicularly intersects the entire peripheral edge thereof, being wide enough to provide a margin surrounding the chamber 26.

Valve means 34a and 34b open or seal off the ends of slot 34 by the rotation of the solid cores 50a and 50b within tubes 52a and 52b respectively. The valve means 34a and 34b may be mounted on the sides of the extruder by any suitable means, this being conveniently accomplished by recessing and welding at the plurality of corner edges 54, the connecting arms 54a and 54b, of tubes 52a and 52b respectively, to the sides of the extruder. A tube member 52a and a core 50a are shown separately in FIG. III. As may be seen in FIG. III tube member 52a is slotted to permit passage of the slidable cartridge assembly 32. The core or valve sealing means 50a is milled along the side of its mid-portion to substantially the depth and width of slot 34 shown in FIG. II. When the core 50a is fitted into tube 52a, maintaining the perspective relationship shown in FIG. III, the valve will be in sealed position with guide screws 58a—58b within the cutaway upper and lower annular grooves of tube 52a abutting the vertical groove surfaces 60a—60b. Rotation of core 50a by turning the hexagonal cap 62a clockwise 90° such that guide screws 58a—58b abut the opposite vertical surfaces of upper and lower annular grooves, will place the valve in open position such that the valve means 34a will constitute an extension of the slot 34 as shown in FIG. I. The purpose of the valve means 34a and 34b is to prevent excessive leakage during extrusion of thermoplastic material, particularly on screen changes and to eliminate partial disassembly of the unit before a screen change could be made. In the illustrated embodiment, the tube and core members are cylindrical. However, these members could be conical, spherical, etc. The hexagonal turning cap 62a can be of any desired shape and can be turned manually or automatically.

The tendency of most thermoplastic materials to leak past the valve means is generally dependent on the fluid viscosity of the thermoplastic material at the temperature

of extrusion. For materials of low fluid viscosity, it has been found that leakage can be further reduced by supplemental cooling of the valves. This may be most conveniently done by hollowing or jacketing portions of the valve means to permit circulation of a cooling medium. One embodiment for supplementally cooling of valve means 34a and 34b is shown in FIG. IV wherein a valve core has been hollowed out and equipped with intake and discharge nozzles 63a and 63b respectively for the circulation of a cooling medium. If supplemental cooling is desired, this alternate valve core could be substituted for the valve core 50a shown in FIG. III.

Referring again to FIGS. I and II the slidable cartridge assembly 32 should have the same cross-sectional configuration as the slot 34. The overall length of the slidable cartridge assembly 32 should be greater than the width of chamber 26 and less than the width of the fixed breaker-plate 23 in the direction of the slot such that the marginal end portions of said cartridge are provided for engagement with the slot wall of the chamber casing 24 and the fixed breaker-plate 23. Since the slidable cartridge assembly 32 has the same cross-sectional configuration as the slot 34, when the slot 34 is of a width greater than the width of the chamber 26 as shown in the drawings the width of the slidable cartridge assembly 32 will likewise be greater and the entire marginal portion thereof will completely surround the chamber 26. The portion of the slidable cartridge assembly 32 intersecting the chamber 26 should be perforated to permit the passage of thermoplastic material therethrough.

As shown more clearly in FIG. V, a preferred embodiment of the slidable cartridge assembly 32 for use in the illustrated extruder comprises a framed perforated holder 64, a screen 66 and a ribbed retainer 68. The framed perforated holder 64 is of a special light-weight construction and comprises an imperforate marginal portion 70 and a perforate portion 72 provided with openings 74. The provision of the marginal portion 70 is designed to substantially reduce thermoplastic material from flowing through the slot 34 during continuous extrusion operation. The perforate portion 72 is of a relatively thin gauge construction and is designed to resist the pressures of extrusion by deriving its basic support from a heavier fixed breaker-plate 23 (see FIG. I) positioned in the extruder immediately downstream of the slidable cartridge assembly 32. The rather narrow and lightweight construction of the slidable cartridge assembly 32 is advantageous for cleaning and considerably reduces the power of the equipment required to change or replace cartridge assemblies. A special feature of the present invention is the provision of a ribbed retainer 68 designed to substantially reduce thermoplastic material from flowing through the slot 34 during screen changes. More specifically, during movement of the slidable cartridge assembly 32 (see FIG. I) ribs 76a and 76b serve to block or prevent severe leakage of the extruded thermoplastic material through slot 34, thereby eliminating loss of extrusion pressures which would result in plastic film breakage and extruder shutdown.

Referring again to FIG. V, the slidable cartridge assembly 32 may be used without the screen 66, in which case the build-up of back pressure will be determined by the size of the openings therein. However, it is preferable to use one or more screens in conjunction with the cartridge 32 in order to more easily regulate back pressure and more efficiently screen impurities from the thermoplastic material being extruded. Only one screen 66 is shown but a plurality of such screens could be used if desired. The ribbed retainer 68 is also used to fix the screen 66 in place; the ribbed retainer 68 snugly engaging the internal edge of the marginal portion 70.

The illustrated die assembly 3 shown in FIGS. I and II comprises a die casing 40 defining a chamber 44 and a die discharge section 46 fixed to die casing 40 by means of a plurality of screws or bolts 48. The chamber 44 is

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of progressively changing cross-section, being of circular cross-section at the plane of abutment with the fixed breaker-plate casing frame 30 and of rectangular cross-section at the plane of abutment with the die discharge casing 46. In accordance with this construction, the die casing 46, in effect constitutes an extension of the fixed breaker-plate casing frame 30 and serves to adapt the cross-section at the plane of abutment with the fixed breaker-plate casing frame 30 to the cross-section of the die discharge section 46. Consequently, the shape of the casing 46 will depend primarily on the cross-sectional configurations of both the fixed breaker-plate casing frame 30 and the die discharge section 46. The illustrated die discharge section as shown more clearly in FIG. VI comprises a flanged base portion 78 and a discharge portion 80 provided with a rectangular opening 82 for the continuous extrusion of thermoplastic sheet material. The dimensions of the rectangular opening 82 will vary according to the desired thickness and width of the extruded thermoplastic sheet. If desired, the discharge portion 80 may be provided with a plurality of rectangular openings for the continuous extrusion of strands of thermoplastic material. However, it is not intended to limit the scope of this invention by the openings provided in the discharge portion of the die as the openings can be of any desired cross-sectional shape, such as circular elliptical, square, rectangular, etc.

#### Operation

Prior to the commencement of extrusion operations, the slidable cartridge assembly 32 is positioned in the slot 34 and centered with respect to the chamber 26 through one of the now open valve means 36a and 36b by means of a retractable ram, not shown. After the ram is retracted, valve means 36a and 36b are closed by rotating cores 50a and 50b 90° counter-clockwise and clockwise respectively. Guide screws 58a and 58b, the latter not shown, will restrict the movement of the cores 50a and 50b to a fully closed or fully open position. The heating coil 16 is then energized and the screw 14 is rotated. When the desired temperature has been reached, thermoplastic material is continuously fed to the bore 12 of the extruder by any suitable means (not shown) and is forced therethrough by means of the screw 14. While in the bore 12, the thermoplastic material is heated to a plastic condition, colloided, and blended with such additives as may be present. The colloided thermoplastic material is then forced by the pressures developed by the screw 14 first through the cartridge assembly 32 and then through the fixed breaker-plate 28. As has been indicated, the resistance offered by the cartridge assembly 32 will increase the back pressure in the chamber 26 and the bore 12. After passage of the thermoplastic material through the cartridge assembly 32, the fixed breaker-plate 28 and the die chamber 44, the thermoplastic material is then forced through the openings 82 of the die discharge section 46 forming a continuous extruded sheet of plastic.

Impurities and uncolloided agglomerates of thermoplastic material will be retained by the screen 66 and as a result, slidable cartridge assembly 32 may become clogged as extrusion operations continue. When this happens it is necessary that the clogged slidable cartridge assembly 32 be replaced. In accordance with the present invention, this is done without interrupting continuous extrusion operations.

While thermoplastic material is being extruded, the valve means 36a and 36b are opened by turning the valve cores 50a and 50b 90° clockwise and counter-clockwise respectively. A fresh cartridge assembly (not shown) of the same construction as the illustrated assembly 32 is then positioned within one end of the slot 34 and brought into abutting contact with one end of the clogged slidable cartridge assembly 32. Force is then applied to the fresh assembly by any suitable means (not shown), such as

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a retractable ram, rod or similar device in order to progressively push the fresh assembly into the slot 34 and force the clogged assembly 32 beyond the chamber 26 where it can be readily pulled out the other end of the slot 34 by manual or automatic means. It is preferable that the replacement operation be performed at a rate such that each increment of the fresh assembly is heated to the temperature of the thermoplastic material within the chamber 26 before being forced therein. However, since the slidable cartridge assembly 32 is of a lightweight construction, its support strength being derived from the mass of the fixed breaker-plate 28, heating of the fresh assembly 32 will occur fairly rapidly, thereby expediting the replacement operation. During the replacement operation, there will be substantially no flow of thermoplastic material out of the ends of the slot 34 due to the sealing effect of the special ribbed retainer 66 provided as a part of the slidable cartridge assembly 32. When the fresh assembly has been properly centered in the slot 34, by any suitable means (not shown), such as a retractable ram, rod or similar device, valve means 36a and 36b are again closed as described above.

Occasionally, a batch of off-grade material may be fed to the extruder. Since the extruder will have been set to extrude in-grade material, it will frequently happen that the off-grade material will be improperly colloided. Generally, such material must be discarded as it is impractical to interrupt continuous extrusion operations in order to modify the design of the extruder. However, in accordance with the present invention, it is frequently possible to quickly and satisfactorily remedy this situation by either increasing or decreasing back pressure, as the case may be, without interrupting continuous extrusion operations. In order to do this, a special slidable cartridge assembly designed to effect the desired change in back pressure is prepared by mounting within a fresh cartridge assembly a screen of different mesh size, a different number of screens, or both. The standard cartridge assembly 32 is then replaced by the special cartridge assembly in the indicated manner without interrupting extrusion operations. As a result of the change in cartridge assemblies, the off-grade material can be satisfactorily colloided and need not be discarded. When the off-grade material has passed through the extruder and the extrusion of the standard formulation is resumed, the special cartridge assembly is replaced by the standard cartridge assembly for the regular formulation.

The above descriptions and particularly the drawings are set forth for purpose of illustration only. Many variations and modifications thereof will be obvious to those skilled in the art and can be made without departing from the spirit and scope of the invention herein described.

#### What is claimed is:

1. In combination in an extruder, an elongated casing defining a lengthwise bore therein, a rotatable screw mounted within said bore, an immovable transverse fixed breaker-plate in the elongated casing between the end of the screw and the discharge end of the casing, said breaker-plate having a central perforate portion whose cross-sectional area is substantially coextensive with the bore, a slot of uniform cross-section perpendicularly intersecting the entire peripheral edge of the bore, said slot being located immediately upstream and parallel to the fixed breaker-plate, and a slidable cartridge assembly positioned in said slot; said cartridge assembly having an imperforate marginal frame sealably fitting said slot and a central perforate portion whose cross-sectional area is substantially coextensive with the bore and a plurality of ribs perpendicular to the slot, the width of said ribs in a direction of flow being substantially equal to the width of the slot.

2. In combination in an extruder, an elongated casing defining a lengthwise bore therein, a rotatable screw mounted within said bore, an immovable transverse fixed

breaker-plate in the elongated casing between the end of the screw and the discharge end of the casing, said breaker-plate having a central perforate portion whose cross-sectional area is substantially coextensive with the bore, a slot of uniform cross-section perpendicularly intersecting the entire peripheral edge of the bore, said slot being located immediately upstream and parallel to the fixed breaker-plate, a pair of valve means associated with and sealing the ends of the slot and a slidable cartridge assembly positioned in said slot; said cartridge assembly having an imperforate marginal frame sealably fitting said slot and a central perforate portion whose cross-sectional area is substantially coextensive with the bore, and a plurality of ribs perpendicular to said slot, the width of said ribs in the direction of flow being substantially equal to the width of the slot.

3. The combination according to claim 2 wherein the pair of valve means are supplementally cooled.

4. An apparatus, adapted for mounting on the discharge opening of an extruder, for controlling extruder back pressures and for improving the quality of extruded thermoplastic materials comprising, in combination, an immovable fixed transverse breaker-plate having a cen-

tral perforate portion whose cross-sectional area is substantially coextensive with said discharge opening, a slot of uniform cross-section perpendicularly intersecting the entire peripheral edge of said discharge opening, said slot being located immediately up-stream and parallel to the fixed breaker-plate, and a cartridge assembly slidably mounted in said slot, the length of the cartridge assembly being less than that of the slot, but sufficient to completely intersect the peripheral edge of said discharge opening, said cartridge assembly having an imperforate marginal and a central perforate portion whose cross-sectional area is substantially coextensive with said discharge opening and a plurality of ribs perpendicular to and sealably fitting said slot.

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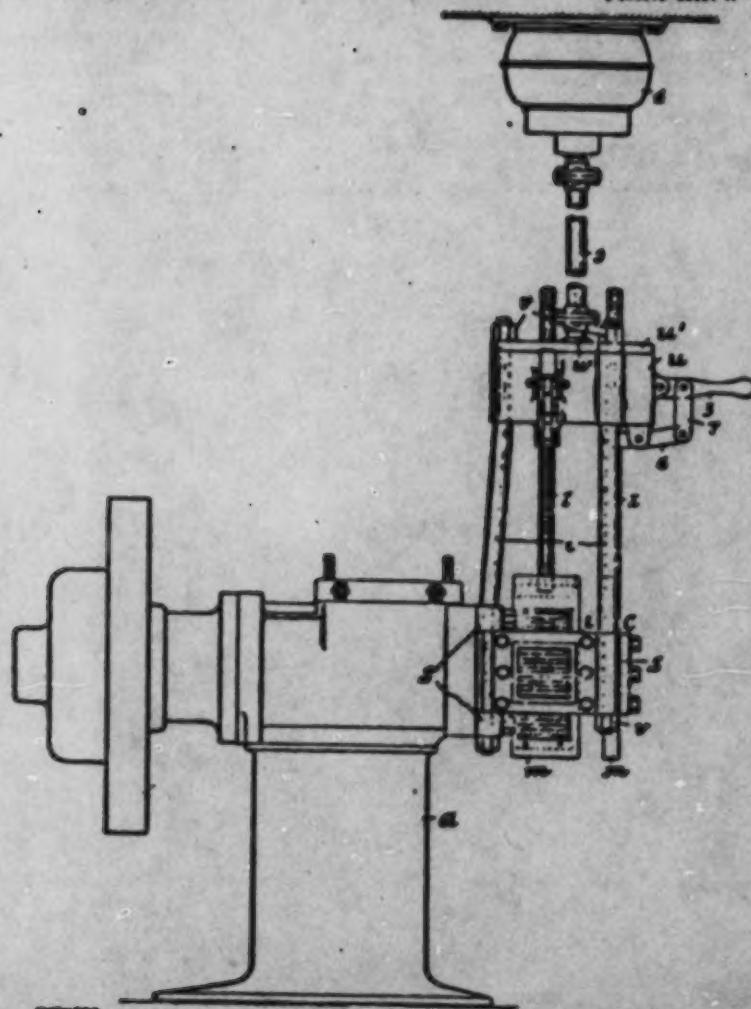
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BUBBLE EXCLAIMING MACHINE.  
APPLICATION FILED MAR. 25, 1916.

Patented Aug. 22, 1918.  
3 SHEETS—SHEET 1.



WITNESSES:

*H. Brill.*

*Fig. 1.*

INVENTOR,

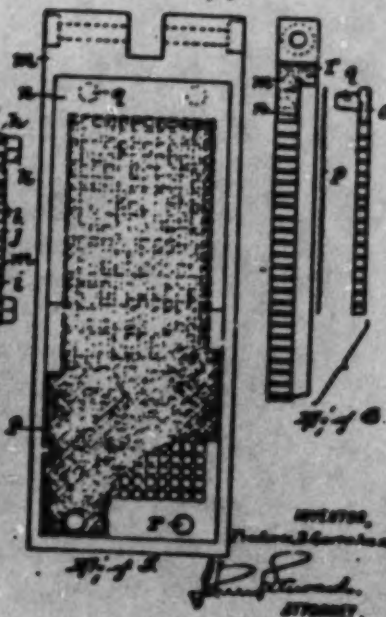
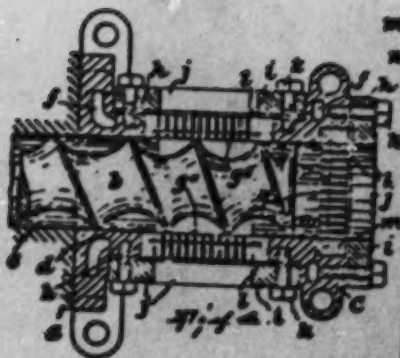
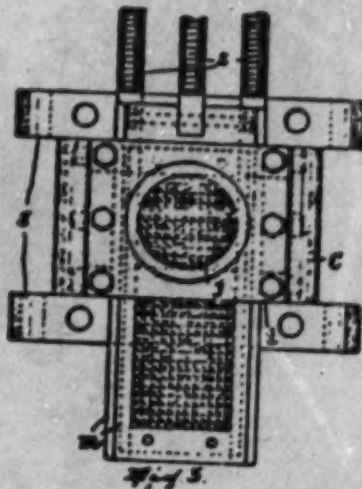
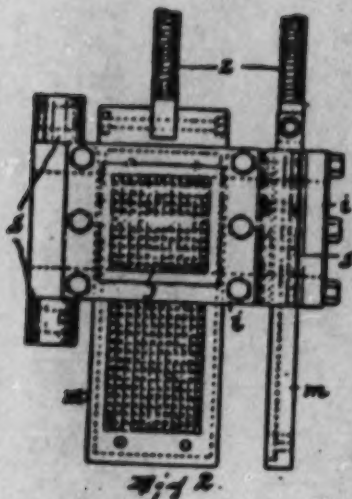
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1,195,576.

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RUBBER RECLAIMING MACHINE.  
APPLICATION FILED MAR. 20, 1916.

Patented Aug. 22, 1916.  
2 SHEETS—SHEET 2.



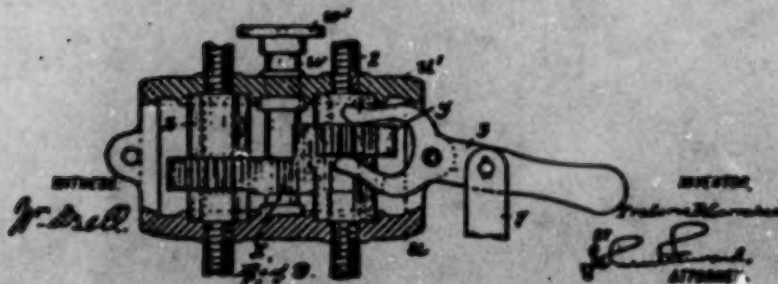
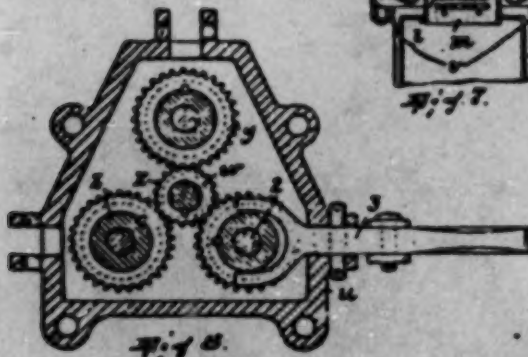
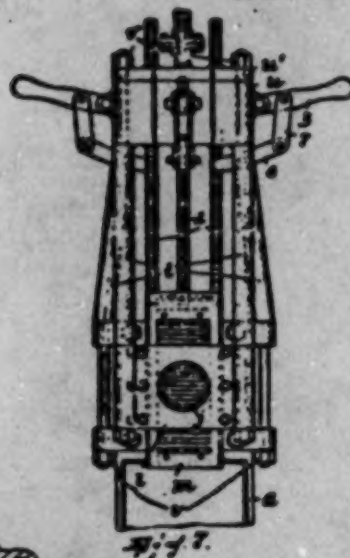
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1,195,576.

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RUBBER RECLAIMING MACHINE.  
APPLICATION FILED MAR. 25, 1916.

Patented Aug. 22, 1918.  
3 SHEETS—SHEET 2.



# UNITED STATES PATENT OFFICE.

FREDERIC B. GARAHAN, OF PATERSON, NEW JERSEY.

## RUBBER-RECLAIMING MACHINE.

1,195,576.

Specification of Letters Patent. Patented Aug. 22, 1916.

Application filed January 23, 1915. Serial No. 74,121.

*To all whom it may concern:*

Be it known that I, FREDERIC B. GARAHAN, a citizen of the United States, residing at Paterson, in the county of Passaic and State of New Jersey, have invented certain new and useful Improvements in Rubber-Reclaiming Machines, of which the following is a specification.

This invention relates to means for straining scrap rubber and the like materials to remove therefrom foreign bodies, such as metal, wood, stone or other hard pieces or particles that have been incorporated therein in the previous uses to which the material may have been put.

One of the objects of the invention is to provide a straining head which may be attached to any suitable apparatus, such as a rubber insulating machine, having means to force the material into and through the straining head and which shall have a strainer or strainers slidable therein in its or their own planes, together with means to move said strainer or strainers from time to time so as to shift one part of the straining area out of the straining position and another into straining position to enable cleaning of the former while the straining operation proceeds uninterrupted, the said means in the preferred form of the invention being carried by the straining head so that live strains and stresses incident to the operation of said means shall be assumed wholly by the head.

Another object is to provide a compact, practical and effective means to shift the straining agent when the same comprises a plurality of strainers.

Another object of the invention is to construct each strainer so that while it will be well adapted to withstand the heavy pressure exerted and to move as easily as possible in the guideways provided therefor in said head, it will also be adapted to facilitate the cleaning thereof.

Another object is to provide for the sliding movement of the strainer or strainers in such a way as to avoid leakage of the rubber.

In the accompanying drawings, Figure 1 is a side elevation of a rubber insulating or tubing machine provided with the attachment including my improvements; Fig. 2 is a side elevation and Fig. 3 a front elevation of the head and certain other parts; Fig. 4 is a horizontal sectional view of the

head; Fig. 5 is an inside elevation of one of the strainers, parts thereof being shown broken away; Fig. 6 shows fragments of the members of a strainer in longitudinal section; Fig. 7 is a front elevation of said attachment; Fig. 8 is a horizontal sectional fragmentary view of the part of the strainer-shifting means which includes a certain gear-box; Fig. 9 is a vertical sectional view thereof; and Fig. 10 is a detail illustrating, partly in section and partly in elevation, a disconnective connection in said means.

*a* is the tubing or insulating machine, and *b* its suitably rotated stock screw projecting therefrom.

*c* is a suitable head provided with a passage *d* which, when the head is bolted properly in place to the frame of the machine *e*, forms a continuation of the passage *e* of the machine in which its said stock-screw rotates, and receives the outer end of said screw, the head being chamfered for the circulation of a heating fluid for keeping the rubber or the like material as soft as possible during the straining operation, as indicated at *f*.

In the preferred construction passage *d* discharges in three directions, to wit, longitudinally and laterally (at both sides) of the screw, as at the outlets *g'* and *g''*, *g'''* formed in the head. At each such outlet, as at *h*, a groove extending vertically is formed in the head from top to bottom thereof, and this groove is covered by a plate *i* having an opening *j* which approximates in size and shape the size and shape of the corresponding outlet, the plate being secured in place in some substantial manner, as by the screws *k*. Guideways are thus formed in which the strainers—to be described in detail—may slide vertically. Between the outer face of the head and each plate *i* is a plate of phosphor bronze or the like material that may be renewed as it wears away.

A good form of strainer that will withstand the heavy pressure imposed thereon and slides as easily as possible in the guideways and at the same time facilitate the cleaning thereof when it becomes clogged and fails therefore to discharge the cleaned rubber is shown in detail in Figs. 5 and 6. Here *m* is a rectangular supporting plate whose horizontal cross-section conforms to that of the corresponding guideway and whose vertical dimension is somewhat more than twice that of its horizontal dimension,

or width; it is formed foraminous as to the major part of its area and has a rectangular recess *n* formed in its inner side and somewhat greater in area than its foraminous portion. *o* is a rectangular foraminous strainer plate which fits the recess *n* and has its perforations formed to register with those of the plate *m*. *p* is a wire-mesh strainer sheet, having perforations of considerably finer gage than those of the plates *m* and *o*. It is arranged between said plates in recess *n*, and when the three parts are assembled the back of plate *o* is substantially flush with that of plate *m*. Plate *o* and sheet *p* are formed in two sections, being divided horizontally at the middle, as shown in Figs. 5 and 6. Plate *o* is also preferably provided with the studs *q* at top and bottom, which enter holes *r* in plate *m* and are adapted to be struck by a hammer or other suitable implement in order to clear plate *o* from recess *n*. Plate *m* serves mainly to support plate *o* and sheet *p*, the former of which holds back, and protects the latter from injury by, the larger particles of metal and other solids in the rubber, and the latter of which holds back the finer particles and shreds of fabric, etc.

The thickness of plate *m* is a trifle greater than the depth of the groove *k* (Fig. 4) so that as wear occurs on the phosphor bronze plates *l* the tightening of the screws *k* will re-establish that intimate sealing contact between the strainer and the outer and inner faces of the guideway which is necessary to prevent escape of the compressed and more or less soft rubber material and which in fact extends continuously around each outlet (*g*, *g'*) of said passage as to each face of the corresponding strainer.

Head *c* is formed with sockets *s* on each side and these receive the reduced lower ends of four pillars *t* whose reduced upper ends are received by corresponding sockets on the sides of a gear-box *u* having a removable cover plate *w*. When these parts have been assembled nuts *v* are screwed on the upper and lower ends of the pillars, making the head, gear box and pillars a substantial and rigid structure and resisting pressure tending to force the head and gear-box apart. Substantially centrally of and in this box is journaled a shaft *w* having a coupling head *w'* and keyed thereon a pinion *a*. Meshing with the pinion and arranged with their axes at the apices of an isosceles triangle are three pinions *y* each splined upon a nut *z* journaled in the gear-box. Each nut is penetrated and has its threading engaged by that of a threaded rod or screw *1* penetrating the gear-box and suitably coupled at its lower end to one of the strainer plates *m*. Forked levers *3* are fulcrumed in the sides of the gear-box and engaged with the respective pinions *y*, affording means to

shift each pinion upwardly out of engagement with the pinion *a*.

The shaft *w* may be driven by any suitable means, as by an overhead reversible motor *4* having its shaft *5* coupled with the head *w'* of shaft *w*.

In operation, when the strainers become clogged with foreign matter to an extent requiring its removal the motor is driven in the proper direction to cause the strainers to rise or fall, as the case may be, until one of the sections of each plate *o* clears the head *c* and the other section is opposite the outlet for the passage *d*. The shifting may be done while the stock-screw remains active to force the material forward in the regular way. Thus a great waste of time (characterizing the operation of machines of this class as heretofore constructed, with strainers that were not shiftable or, if so, were shiftable only by hand, and hence only when the stock-screw was idle) is avoided in the use of my apparatus. When the strainers have been shifted the clogged part of each is cleaned,—an operation that is facilitated by the removability of the plate *o* and sheet *p*.

I am aware that it is not new to shift a straining agent in a rubber straining apparatus to change the draining area from time to time to permit cleaning of the strainer when clogged at one place while the straining operation proceeds with respect to another, as already intimated. But the apparatus heretofore proposed has not been provided with means to shift the straining agent; wherefore the straining operation, on account of the great pressure involved, had to be stopped until the shifting could be accomplished by hand. It is a matter, moreover, of considerable importance that the said means be carried by the straining head and not some other support, not only because it produces compactness and makes the straining apparatus self-contained, but because the strains and stresses incident to shifting the strainers against the resistance of the adhering and greatly compressed mass of rubber are not then operative to loosen or disrupt the means for securing the head in place.

Should it be necessary or desired for any reason not to shift all of the strainers at once the pinion *y* corresponding to each strainer that is to remain stationary is by means of lever *3* shifted on its nut *z* until it clears the pinion *a*.

To prevent injury to the parts by neglect to check the upward shifting operation in time I provide a lever *6* fulcrumed in the gear-box and having one part in the path of the rising strainer and the other connected with the handle or free end of lever *3* by the link *7*, whereby the pinion *y* corresponding to said strainer will be shifted out of mesh with pinion *a*; in the downward

movement no injury can occur through neglect to check it in time, because the shifting will cease as soon as the threaded rod clears the nut.

8 Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A straining apparatus including, in combination, a straining head having a passage therethrough, means to force the material to be strained through said passage, a strainer slidable in its own plane in the head across the passage, and means, carried by said head, to shift the strainer in said plane to oppose first one and then another portion of its straining area to said passage.

2. A straining apparatus including, in combination, a straining head having a passage therethrough, means to force the material to be strained through said passage, a plurality of strainers slidable in their respective planes in the head across said passage, and means, yoking said strainers together and carried by said head, for shifting the strainers in synchrony.

3. A straining apparatus including, in combination, a straining head having a passage therethrough, means to force the material to be strained through said passage, a strainer slidable in its own plane in the head across the passage, a framing carried by the head, and a system of moving parts carried by the framing for shifting the strainer.

4. A straining apparatus including, in combination, a straining head having a passage therethrough, means to force the material to be strained through said passage, a strainer slidable in its own plane in the head across the passage, a framing carried by the head, and a screw-and-nut connection between said strainer and framing.

5. A straining apparatus comprising, in combination, a fixed structure including a straining head having a passage therethrough, means to force the material to be strained through said passage, a strainer slidable in its own plane in the head across

said passage, and means, including a moving system of parts having a disconnective connection between two of them, for shifting the strainer in said plane.

6. A straining apparatus comprising, in combination, a fixed structure including a straining head having a passage therethrough, means to force the material to be strained through said passage, a strainer slidable in its own plane in the head across said passage, means, including a moving system of parts having a disconnective connection between two of them, for shifting the strainer in said plane, and means, controlled by the moving strainer, for controlling said connection.

7. In combination, with a straining head having a passage therethrough and means to force the material through said passage, a strainer guided in the head for movement in its own plane across said passage and including two separable foraminous plates normally held face to face by the head and interlocked against relative movement in their respective planes and one being divided into two sections transversely of the path of movement of the strainer in the head, the strainer being movable in each direction to clear one of said sections or the other from the head.

8. In combination, with a straining head having a passage therethrough and an exterior groove communicating with and extending crosswise of said passage and with means to force the material through said passage, a plate-like strainer structure slidable in said groove and having a thickness greater than the depth of the groove, an apertured means overlapping and forming with said groove a guideway for the strainer, and adjustable means to draw the apertured means toward the head, said strainer having a continuous sealing contact around said passage on one side with the head and on the other with the apertured means.

In testimony whereof I affix my signature.  
FREDERIC B. GARAHAN.

EXCERPTS OF CROSS-EXAMINATION TESTIMONY  
OF KALMAN'S EXPERT GEORGE C. PICKERING

Appearing at pages 141-44 of Trial Transcript:

Q Have you read the Moziak patent?

A Yes, I have.

Q Are you familiar with what the Moziak patent discloses?

A I think I am, yes, sir.

Q I think you testified with respect to Exhibit 66, did you not?

A Yes.

Q The type of screen changer that you characterized this being?

A I said it is a slide, it's a modified slide screen changer from a process standpoint. It does the same task that a slide screen changer does.

Q And your reasons were?

A It's a two-piece screen device, one of which is exchanged for the other in front of the filtering medium.

Q When he wants to change his filter --

A Right.

Q -- opens that valve so that's open, right?

A Right.

Q It's not shown here, 'cuz it's --

A Not shown.

Q -- because of the drafting technique. But he would turn this valve and would be open all the way across, wouldn't it?

A It would.

Q Would you look at Moziek in that frame of reference for me, please, and have that in your mind? This valve open, that valve open, a new screen pack assembly coming in and pushing the other one out?

A Right. That's what happened.

Q In that frame of reference --

A Right.

Q -- I'd like to ask you some questions on that. Does Moziek disclose a process for filtering a heat sortened substance flowing through a passage?

A Yes.

Q Passage being here, right?

A Right.

Q At least to that respect, Moziek is just as pertinent as the file wrapper references that we were discussing before, isn't that true?

A He's as pertinent.

Q At least as to the disclosure of being applicable to a heat softened substance it is more pertinent, is it not?

A It's as pertinent.

Q It's not more pertinent than Avery, Beduhn -- let me get them -- Moreton, Mickle, Doubleday, Avery and Beduhn, at least to the purpose of filtering a heat softened substance

would you say that those were just as pertinent as Moziek for that one principle?

A To the questions or to the, to the --

Q To the pertinency of being related to a device for filtering a heat softened substance?

A Well, that's different than being pertinent to the patent.

Q I realize that. But that's not the question I asked you.

A Related to that substance, that subject, yes.

Q Moziek's more pertinent?

A It's more pertinent to that subject.

Q Sure it is. You have pictured Moziek in the operative mode I've given you, haven't you?

A Yes, sir.

Q Does Moziek use the step of introducing a filter by passing it through inlet and outlet ports flanking the passage through which the material is being filtered?

A Well, he takes it through the valve opening.

Q So, your answers are yes?

A If you equate a valve opening to a port.

Q You don't want to call that a port?

A Well, it's a port when it's open and it's not a port when it isn't open.

Q We are discussing it when it's open.

A Yes, and I'm reminding you that it is not always open in the total process.

Q Fine. And I would like you to answer the question in that operative mode. Is it a port?

A When it's in that mode, it is a, it can be a port, yes, I'll agree.

Q Does Moziek show having a part of his filter extend across the passage through which the material being filtered is flowing?

A He shows having his holes filled, sir.

Q We are looking -- and you're forgetting -- I'm giving you this parameter. Both ports opening, the new one coming in, let's say it's just pushing one quarter of the way into the passage and the old one pushing out. Doesn't he say he affects a screen change that way?

A Yes, he does.

Q At that time does Moziek show a part of the filter extending across the passage?

A By passage, you mean the passage for the melt?

Q The passage for the melt.

A Yes, it does, at that time.

Q To filter the substance, right?

A It is, still undergoing filtering, yes.

EXCERPTS OF CROSS-EXAMINATION TESTIMONY  
OF KALMAN'S EXPERT GEORGE C. PICKERING

Appearing at pages 148-49 of Trial Transcript:

Q What would be the reason it would help stop the excess leak?

A Because it could be cooling it down coming through the small surfaces, the small crevices between the valve stem and the valve body.

Q And when you cool a thermoplastic material down, what happens? [Question read back below]

MR. SILVERMAN [Counsel for Kalman]: Mr. Santisi, would you let the witness finish when he is in the middle of a sentence?

THE WITNESS: I'm sorry.

THE COURT: Have you finished?

THE WITNESS: I'm sorry. It may not have looked it.

MR. SANTISI [Counsel for K-C]:

Q I thought so. Do you want that question repeated?

A No, I --

Q I can have the question --

A I'm sorry. We got lost in the question.

MR. SANTISI: Could I have the reporter read that question?

[Question noted above read back by reporter.]

A I thought I answered that.

MR. SANTISI:

Q I missed it then if you did. I'm sorry.

A Again, if that port was filled up with leaking material from around the filter plate with the valve closed and it started to leak some more and you put water on it, you would, if it's leaking out through some small crevice between the two parts of the valve and you cool the valve, it will stop that excess leak from that excess material in that chamber.

Q And my question was why will it stop excess leakage?

A Because the material will freeze up in it.

Q Form a plug?

A If you want to call it a plug.

Q A solidified mass of material. How's that if you don't want to call it a plug?

A All right.

EXCERPTS OF CROSS-EXAMINATION TESTIMONY  
OF KALMAN'S EXPERT GEORGE C. PICKERING

Appearing at pages 176-77 of Trial Transcript:

Q Suppose I put one of those types of valves at 50A, and I flowed a cooling medium through the port that Mr. Moziek says I may provide. Would you feel that that would sufficiently cool the area of the slot immediately adjacent to that valve, to a sufficient degree to solidify the thermoplastic material, so as to form a plug?

A It is conceivable that if you put enough cold in here you can work it back to form a plug way back in here. Or a total plug of any size in here. Your hypothetical to me was there was no leakage. No leakage. You see no leakage. Implying it could be as far back as here. My answer first was, it could be anywhere in here. Up to filling it, all the way back to here. And the last point of freeze off would be at the top. In here.

Q Your answer was that a plug could be formed there.

A A plug could be formed here or anywhere in here. Depending upon how much temperature you pour in here, how much heat you've got in here.

Q Right.

A It is way up in here.

Q He doesn't tell you in his Patent, temperatures, does he?

A He doesn't go into this, no.

Q But if that plug was formed --

A Which plug? There are several potential plugs. The cold plugs --

Q Any one of them. If any one of the plugs you mentioned were formed, would that plug act to prevent substantial leakage of the thermoplastic material out the inlet and outlet ports?

A Some plugs could some might not. This being way in if we have a substantial leakage, it would come out into the port as Moziek testified. And if this was cold, then, it would start to freeze in here as a plug.

Q But the possibility exists when we analyze the Moziek that that might happen, doesn't it?

A That it could form a frozen plug in here with cold water here, yes.

EXCERPTS OF CROSS-EXAMINATION TESTIMONY  
OF KALMAN'S EXPERT JOHN S. O'BRIEN

Appearing at pages 341-48 of Trial Transcript:

Q You're right. Thanks. Now, my question to you is with that disclosure of the patent, is it your testimony that Mr. Moziek is telling me when my valves are closed, if I want to cool, but during my screen change operation when I'm opening the valves, first shut off my cooling medium, then open the valves; is that your testimony that this disclosure

--

A After the word "but" in your sentence there's no disclosure of any kind pertaining to what you stated.

Q So, if he teaches me to use a cooling medium, am I going contrary to the teachings of Mr. Moziek if I refuse to shut off my cooling medium when I rotate my valve?

A No.

Q Okay. So, I'm going to operate it in that mode and run my cooling medium while I open my valves?

A All right.

Q If you look at that apparatus, operating in that condition, don't forget I'm still a sloppy machinist, and the stuff doesn't leak out, do you have an opinion as to why?

A In other words, you have first experimented with your various cooling media?

Q Yes, sir.

A You finally found one?

Q It might be liquid nitrogen, but I finally found one.

A At which point nothing comes out?

Q Yeah.

A I think you're justified in concluding that you had transferred enough heat away from the oncoming hot plastic melt to reduce its viscosity at least and partially or fully solidify it at a point where it would block the passage 34, slot 34.

Q Would you call that a plug?

A A plug, yes, I'd call that a plug, if that's what it was.

Q Mr. Pickering refused to acknowledge plug; he called it a slug.

A I'm not responsible for Mr. Pickering's testimony.

Q But you acknowledge if that hypothetical condition was, that would probably call whatever was in there stopping the leakage a plug?

A Yes, I would say so.

\* \* \*

Q I'm setting it up. Okay?

A You got the cartridge in there.

Q Right.

A And how is that positioned?

Q Just ready. Okay? Now I'm going to do what Mr. Moziek says, advance it. Okay?

A Yes.

Q Abut and push. Okay?

A You're going to do the whole operation.

Q Yeah.

A You want me to read it on that while it's undergoing that operation.

Q Let me ask you a question. You can sit there.

A All right.

Q In that mode, would you say that that device is a filtering device, filtering a heat softened substance?

A Would you turn it just a wee bit?

Q All right. Can you see it now?

A Now what?

Q With those parameters, do we have a filtering device for filtering a heat softened substance?

A Yes, we do.

Q Does it include a body defining a passage through which that substance can be caused to flow?

A Yes, it does.

Q Does it have in that condition slotted inlet and outlet ports flanking said passage?

A Yes, it does.

Q Can you pass a filter through those slotted inlet passages?

A Well, you can do all sorts of things. But hwat is being done --

Q Can you, in those parameters, pass a filter through in slotted inlet and outlet ports?

A Filter of proper dimensions.

Q Filter of proper dimensions.

A Which is at least as long as the complete width of that structure. The answer is yes.

Q If I did that, and I kept pushing, would I introduce different parts of that filter across this passage?

A Yes, you would.

Q Are the ports -- don't forget we have evolved -- I finally got a material that doesn't leak out -- do the ports, are they adapted, that's the inlet and outlet, are they adapted for formation therein, in use, and that is the use I'm talking about, of sealing plugs?

A That's the use you're talking about. But I'm the one who's reading the Claim.

Q Sir, but I'm asking you the question.

\* \* \*

A Now, you're telling me --

MR. SANTISI:

Q Sir, I am going to ask the question, and I would like a precise answer to the precise question I ask you.

A If I can, yes, sir.

Q And I might change the words of the claim, so listen carefully.

A Now, if I cannot answer it, I'll say so.

Q Absolutely. And, then, I will try to pose it so you feel competent to answer it.

A Now, I am reading the claim, correct?

\* \* \*

Q All right. I have found, after trial and error in my cooling medium --

A Yes. I understand. You're now at Element 2B on my Chart 60B.

Q Would you say that that hypothetical device had ports adapted for the formation therein, in use, -- this is the use we're talking about, the movement use, the movement of the screen across, of sealing plugs of the substance being filtered?

A That's all.

Q That's it.

A Yeah.

EXCERPTS OF CROSS-EXAMINATION TESTIMONY  
OF KALMAN'S EXPERT JOHN S. O'BRIEN

Appearing at pages 355-56 of Trial Transcript:

Q Thank you. How long does a band have to be?

A No particular length. Long, use the definition you read for the record.

Q My gold watch band, that's a band?

A Right.

Q Suppose I tell you I had a screen assembly as shown in Moziek's Figure 5. See that?

A Yeah.

Q And suppose I -- it's three pieces, the tray, the screen, and the screen holder, do you see those three?

A I see that.

Q Assembled together. Suppose I told you that the width of my assemblage, the three parts, was two and a half inches and 22 inches long. Would you call that a band?

A It may be called a band.

Q Six inches long?

A Might be called a band.

Q How about .4 inches by 3 inches?

A Start that one again?

Q .400 inches by 3 inches, or 1 inch by 3 inches, is that a band?

A Yes.

EXCERPTS OF CROSS-EXAMINATION TESTIMONY  
OF KALMAN'S EXPERT JOHN S. O'BRIEN

Appearing at page 358 of Trial Transcript:

Q Well, let me pick out another patent. You picked Kalman. How about Garrahan 5?

A Yes. I'm familiar with Garrahan.

Q Does he show a long plate extending out?

A He shows having a band, if you will.

Q He shows having a band, if I will. Yes, I will have that as a band. Do you have Garrahan 5?

EXCERPTS OF DIRECT TESTIMONY  
OF K-C'S EXPERT DEAN DON A. FISCHER

Appearing at pages 518-26 of Trial Transcript:

Q I would like to put up a chart of the claims of the Kalman patent with the Moziek device. And ask you, Dean Fischer, if you can provide your opinion as to whether the invention claimed in Claim 1, taken in conjunction with the prior art, particularly the Moziek patent, can be read element for element on the prior art devices that you have rapidly explained?

A The Claim 1 calls for a process for filtering a heat-softened substance flowing through a passage comprising the steps of. That, of course, is what Moziek is about. Then it states introducing a filter in the form of a filter band or ribbon by passing it through inlet and outlet ports flanking said passage so that a part of the filter extends across said passage. Well, I believe that the, that through the cartridge in Moziek with the screen in the, is in the form of a band or a ribbon. And then you do pass it through inlet and outlet ports when you're changing screens.

Both of these patents are about changing screens. And, so, you, when you put it in and move it across through to the outlet port, it goes through the inlet port and when it moves it goes out the outlet port. Even with the size shown. And, as a matter of fact, with even with the size shown in the, in the other view of the Moziek patent, this 32, this

side of the screen is over on this pink abutment. So, it does extend across the breaker plate.

But at any rate, you do pass this filter through the inlet and outlet ports. There's no requirement in the claim that it has to extend into the inlet and into the outlet port at the same time. And, as a matter of fact, if you said that, you wouldn't have to use the word "part" in here.

The claim says so that a part of the filter extends across said passage. Then the claim goes on to state, forcing the substance through the filter part to filter said substance whilst providing temperature conditions at said inlet and outlet ports resulting in the formation within said ports of sealing plugs of said substance of adequate rigidity to prevent substantial leakage at said ports.

Well, there's cooling, as we've all seen, there's cooling in the valves of the Moziek patent. And whether the valves are opened or closed, you do form, you do form hardened material which forms a seal around the exit port and around the inlet port. Now --

Q Does Moziek teach cooling both valves?

A Both valves, yes. It's plainly stated in the patent that you cool -- it would be 50A and 50B, they use different numbers because they're referring to the first figures, but there's not the slightest doubt that both valves are cooled, inlet and outlet valves. It says, to prevent substantial leakage at said ports.

Well, this is sort of a functional limitation, and the only way you could tell if you had that was to make a model and try it out. Well, I saw the model work. And, in my opinion, there was not substantial leakage. So, this is a very indefinite term. What is substantial leakage? But, in my opinion, there wasn't substantial leakage.

Then the claim goes on to state, when desired effecting movement of said filter through said ports under conditions providing for self-maintenance of said sealing plugs to introduce another part of said filter band or ribbon into said passage. Well, Moziek does this, and, to me, the demonstration confirmed my opinion, because he did self-maintain the sealing plugs to prevent any leakage and we introduce another part of said filter band or ribbon into said passage.

Now, when you put two of these together, just pushing each other. Of course, that's part of the band like a watchband, if you have three, you have a longer band. And if you should decide to link them together, you still have a band.

Q Do you --

A So, in my opinion, Moziek shows the things called for in Claim 1, if there's one condition. However, I believe that this phrase says, when desired effecting movement of said filter through said ports, I believe that refers to the difference of pressure in Kalman which moves the filter back and forth.

Q And Moziek does not show it?

A And Moziek does not show that. So, if this claim were interpreted as I would interpret in the means that you need the difference of pressure to do the moving -- and that's based on my reading of Claim 7, also -- you need a difference in pressure to do the moving. And Moziek does not use a difference of pressure to do the moving. But if you make this claim broad enough that this covers a ram or anything else, then Moziek would fulfill the requirements of the claim.

Q Do you feel among all the prior art that we have briefly discussed here today that there is a fair teaching to ultimately end up with a system that we saw demonstrated today, that is, the linked plates passing through the Moziek ports?

A Yes, I do. I don't believe -- I believe it would be obvious to almost anyone, let alone a man skilled in the art, that if the plates were separating you could link them together.

Q And that would be prior to 19, February 21, 1967, based on the prior art available to you?

A Yes.

Q Because that is the critical date for the Kalman patent?

A Yes.

\* \* \*

Q Would you now give us your opinion as to your interpretation of the applicability of the Moziek patent, Exhibit 35 against Claim 18?

A Yes. Claim 18 calls for a filtering device for filtering a heat-softened substance. And that, of course, is what Moziek is. Then the claim states, a body defining a passage through which said substance can be caused to flow. Well, that would be the body, screw 14 is in the body, and the substance flows through that body and down through and out the bottom of Moziek. So, Moziek has that.

Slotted inlet and outlet ports flanking said passage. Well, there's a port on the left and there's a port on the right. And they're labeled, I would guess 56A and 56B. Would point to a part of the ports. The ports are plainly shown. There's one on the right and one on the left. So, they flank the passage. And the passage that they're talking about is through here, from top to bottom, the way the plastic flows. And they flank the passage.

Through which a filter in the form of a band or ribbon is passed and can be moved to introduce different parts of said filter across said passage. So, there is a filter, of course, and it's in the cartridge 32 and it's in the passage, as the claim calls for. And this is if this claim is interpreted to be so broad that it's not limited to the difference in force causing the movement.

Then the claim goes on to state, said ports being adapted for the formation therein in use of sealing plugs of

the substance being filter permitting movement of said filter through the slots without substantial leakage of said substance. It uses the word "adapted," the ports being adapted. Well, Moziek's ports are adapted to do that. Whether he -- whether it's explicitly stated or not, we saw in the demonstration today that the ports could work to form sealing plugs even though they were left open. And there's nothing -- if you have a Moziek device and you, and you left the valves open, then it, it would infringe this claim; whereas maybe if you close the valves it wouldn't infringe the claim and that, of course, would be a difficult thing. You'd have a difficult time deciding whether it infringed or not.

So, the ports in Moziek, in my opinion, are adapted for formation therein in use of sealing plugs of the substance being filtered permitting movement of said filter through the slots without substantial leakage of said substance. And what I said about substantial leakage, is, I'd state it here again, I don't think there was what I would call substantial leakage. And the term is really indefinite. And that's the way the Moziek patent worked. I means, I saw the device demonstrated and I have previously checked the device to see if it conforms to that, the Moziek patent.

Q I think you forgot the last element.

A What?

Q The means --

A I'm coming to the last column.

Q Oh.

A And means to provide temperature conditions at said ports to form said plugs. And the temperature condition in Moziek is formed by coolant going through those tubes shown in Figure 4, the tubes 63B and 63A is the tube for the coolant. So, that's the last element in the claim, and it's met by Moziek.